

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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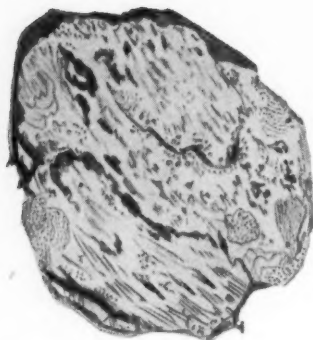
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Reprints upon request; also, special literature in English, Spanish, French, German, or Italian



DAVIS & GECK, INC.

LABORATORIES, 217-221 DUFFIELD STREET, BROOKLYN, N.Y., U.S.A.

Branches in San Francisco, Seattle, and London

ANNALS *of* SURGERY

VOL. LXIV

DECEMBER, 1916

No. 6

TISSUE FRAGMENTS AND WOUND INFECTION

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IN the course of injury by the missiles utilized in the present war, a wound may be left containing several kinds of foreign body. There may remain, first, the missile itself; second, fragments of clothing; thirdly, detached or severely traumatized tissue fragments. Such danger as there may be from the presence of the missile itself depends on its position, its shape and size, and especially its sharp edges, for on this depends the local tissue erosion which may result in serious hemorrhage or other damage to the structures in the immediate neighborhood of the missile. On its size and irregularities depends also to a large extent the number of bacteria with which it is charged and from which a focus of infection may arise. The danger from the shreds and fragments of clothing distributed along the track of the missile depends only on the load of bacteria which they contain. The danger from the fragments of detached tissue in the wound lies in the ready-made medium for bacterial growth which they constitute. Thus the injury has usually supplied two factors favoring infection: the supply of devitalized tissue for culture medium and the inoculation with bacteria.

The importance of removing the missile and the cloth is well recognized, but sufficient attention is rarely directed to the removal of the tissue, which is a hotbed for the initial incubation and multiplication of the bacteria.

With a view to determining the relative importance of a foreign body and of dead tissue in the initiation and rate of extension of infection in wounds, the following experiments were undertaken.

Technic.—The technic used for inoculation was the same for each of the experiments. The animals were anesthetized, the operative fields shaved and painted with iodine, incisions made in the skin and muscle fascia and the implantations and inoculations made through a sterile glass tube inserted into the muscle

mass. The wounds were then closed by one suture through the muscle fascia and another through the skin. The skin wounds usually healed promptly. Discs $\frac{1}{2}$ cm. in diameter, stamped out of previously sterilized soldiers' cloth, were used as the type of foreign body for the implantations. For the tissue fragments pieces of muscle, excised from the wound and cut out as nearly as possible the size of the cloth discs, were used. They were handled and reinserted with aseptic precautions. One drop of a broth culture of the different organisms was the dosage employed in each inoculation.

Whenever possible comparative experiments were made in the same animal in order to reduce the factor of individual variation in the reaction and infection.

Experiment 1. Tetanus.—Nine guinea-pigs were anesthetized, and an incision made in the skin and muscle of the right thigh. Into each was inserted, through a sterile glass tube, a fragment of cloth which had been previously smeared with an emulsion of garden soil (proved to contain tetanus bacilli and other organisms) and dried. One animal died of tetanus four days after inoculation. All the others developed a moderate inflammatory reaction resulting in a small abscess formation. Six other guinea-pigs were inoculated in the same manner with the same infected cloth, and simultaneously a piece of muscle about the size of the cloth was excised and reinserted with it. Three of these animals died of tetanus on the third day, the other three on the fourth. In all six a very acute and extensive inflammatory reaction resulted from the inoculation. The addition of the fragment of muscle tissue appears to be the only factor to account for the difference between the reactions in the two series of animals.

Experiment 2. Staphylococcus aureus.—Three guinea-pigs were anesthetized. Into the right thigh of each was inserted first the fragment of muscle, then one drop of the bacterial emulsion, and finally the cloth disc; into the left thigh bacterial emulsion followed by cloth; into the right lumbar muscles a piece of sterile cloth alone; and into the left lumbar muscles one drop of bacterial culture alone. After forty-eight hours the right thigh of all three showed extensive palpable induration. The left thighs did not appear to be swollen. No reaction was evident over the right lumbar muscles, but there appeared to be a slight degree of swelling about the wound in the left lumbar muscles. All the skin wounds appeared to be clean and dry, and the skin united. On the fifth day the animals were killed, hardened entire in formalin, and subsequently dissected. In all three cases the right thighs showed large irregular abscess cavities from 1 to 3 cm. in diameter within the muscles and enclosing the cloth. The left thighs of all three showed small cavities firmly enclosing the cloth and slight diffuse inflammatory reactions throughout the neighboring portions of muscle, which had not, however, proceeded to abscess formation. In all three the fragment of cloth implanted in the right lumbar muscles was firmly embedded. The tissues surrounding showed no other evidence of inflammatory reaction. In all three cases the left lumbar muscles showed a limited area of infiltration but no abscesses. Results:

- (1) The presence of a piece of sterile cloth produced no reaction beyond its fixation in the tissues.
- (2) The presence of cloth in conjunction with *Staphylococcus aureus* produced much more extensive involvement of the tissues than inoculation with a similar amount of the same infective agent without a foreign body.
- (3) The presence of the additional factor of dead tissue produced a still

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more extensive and *much more rapid* infective process, resulting in an earlier abscess formation.

Experiment 3. B. aerogenes capsulatus.—Three guinea-pigs were anaesthetized and the previous experiment repeated in exactly the same manner, using a twenty-four-hour dextrose broth culture of the *B. aerogenes capsulatus*. In addition to the four inoculations practised in that experiment, a piece of sterile muscle alone was inserted into the muscles of the right foreleg and a piece of sterile muscle together with one drop of the bacterial emulsion inserted in the muscles of the left foreleg. After twenty-four hours both the left and right thighs and the left foreleg of all three were swollen. In each case the right thigh was much larger than the left. The other wounds showed no reaction. The animals were killed on the third day, hardened as in the first experiment, and dissected. All three cases showed abscess cavities varying from 1 to 1½ cm. diameter in the right thigh. In addition there was considerable suppuration between the muscle bundles and a purulent extension along the muscle sheaths. The left thighs showed no abscess cavities in any of the three animals, but a varying amount of purulent infiltration which had not reached the stage of abscess formation. The sterile cloth implanted without inoculation was firmly embedded and there was no evidence of other inflammatory reaction about it in any of the animals. The wound containing bacteria alone showed in each case a very small area of purulent infiltration about the wound. The right forelegs, in which sterile muscle alone had been implanted, showed in one case a secondary infection of the wound and in the other two no reaction beyond some hemorrhage—probably operative. The left forelegs showed in two cases extensive purulent induration of the tissues about the infected fragments of dead muscle with some evidence of gas, and in the third case numerous small abscesses 2 to 3 mm. in diameter as well as considerable subcutaneous hemorrhagic exudate in the region of the wound. Thus the results of this experiment were parallel to those of the experiment with staphylococcus, and seemed to indicate that in the presence of infection by the *B. aerogenes capsulatus* the presence of dead muscle tissue was the most active contributory cause of a rapid extensive inflammatory process.

Experiment 4.—A further experiment was performed, using the same operative technic, with streptococci for the infective agent. Two animals were used. In the right thigh of each was inserted a fragment of muscle, then one drop of a forty-eight hour broth culture of streptococcus, which in turn was followed by a piece of sterile cloth. In the left thigh was inserted one drop of the same bacterial emulsion followed by a piece of excised muscle. In the right lumbar muscles was inserted one drop of the same emulsion followed by a fragment of sterile cloth; and in the left lumbar muscles one drop of the bacterial emulsion alone. Four days later both animals showed a thin milky discharge from right and left thighs and some induration about the wound in the right lumbar muscles. The wound in the left lumbar muscles showed no reaction. Four days later the wounds again appeared to be closed, the animals were killed, and the parts involved hardened in formol and dissected. In one the right thigh showed a small abscess containing the cloth and one or two drops of thin creamy pus. In the other the right thigh showed the cloth embedded in the muscle with purulent infiltration of the muscle tissue surrounding it. The left thighs were about equal in size to the right in both cases, and both showed a small fistulous tract extending

from the external wound to a small local area of infiltration and necrosis of muscle tissue. The right lumbar muscles in both cases showed the cloth firmly embedded in the muscles with no evidence of inflammatory process except a very slight induration about the cloth. The left lumbar muscles showed no signs of inflammation.

The results of this experiment resemble strongly those of the preceding ones. In the case of both these animals the most prominent inflammatory reactions were associated with wounds containing dead muscle tissue. The wounds containing infected cloth alone produced a comparatively mild reaction, while those containing infected cloth and muscle or infected muscle alone produced fairly extensive macroscopic lesions. The inoculation of the streptococcus alone into the uninjured tissue produced no obvious damage.

Summary.—From these four experiments the following facts may be restated:

1. The implantation of a sterile foreign body or a small piece of sterile dead muscle alone produced no macroscopic lesions.
2. The implantation of a foreign body infected with tetanus bacilli, *Staphylococcus aureus*, *B. aërogenes capsulatus*, or streptococci produced usually a localized abscess formation without invading the surrounding normal tissues.
3. The addition of a small portion of dead muscle tissue in the region of the infection produced a *more rapid* and *diffuse* inflammatory process with earlier and more extensive abscess formation than the wounds containing only bacteria or those containing infected cloth.
4. The implantation of infected cloth together with muscle tissue produced a more active and destructive lesion than the implantation of either alone. When infected with tetanus bacilli the presence of dead muscle fragments determined a high mortality.
5. Of the two substances, cloth and devitalized muscle, in the presence of infection, the muscle produced the more acute infective process.

CONCLUSION.—The result of these experiments suggests that in the cleaning of fresh wounds at least as much care should be exercised to remove separated and devitalized fragments of soft tissue as is taken to remove other foreign bodies.

In all operative procedures where blunt dissection is practised it should be remembered that torn fragments of devitalized tissue may remain to become a ready soil for the incubation of any bacteria which may gain access to the wound.

BLOOD-PRESSURE AND GRAPHIC VASOMOTOR CHANGES IN THE PERIPHERY DURING ETHER ANÆSTHESIA*

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IN a former paper¹ were set forth the results of a number of experiments on animals to determine and demonstrate graphically the changing conditions of the peripheral vessels during shock brought on by intestinal trauma.

The animals used were anæsthetized with ether, and the question naturally arises as to what depressing, exciting or neutralizing effect the anæsthetic may have had on the vasomotor mechanism.

The great importance of the general physiological effect of ether on the human organism, and the dangers connected with its use, have stimulated scores of physiologists and clinicians to experiment and observe. These investigators have attacked the problem from almost every angle, and as a result we have a great mass of observations, corroborating and disagreeing with each other.

The Question of Blood-Pressure.—As to the state of the blood-pressure during short or long-continued anæsthesia with ether, the consensus of writers seems to be that in the first stage of anæsthesia there is a sharp rise of blood-pressure. Verworn², speaking of anæsthetics and the wide-spread relation between excitation and depression, says: "It appears to be a general property of these (anæsthetic) substances that in very small doses or with very brief administration they produce the phenomena of excitation" The observation that there is a rise of blood-pressure at first also agrees very well with the noted phenomena of the excitement during the first stage of anæsthesia by ether. Patton³, after summing up the conclusions of other workers, says that a stimulation of the circulation is generally noted by observers. Kemp⁴, in his experiments on animals, showed a rise in general arterial pressure. MacWilliam⁵, on the other hand, claims there is a general but slight fall in arterial pressure.

Observers also concur in statements that in long-continued ether anæsthesia there is a decided fall in blood-pressure. This phenomenon is well in accord with the observed action of increasing doses of anæsthetics on the individual cells of the organism, as shown by Verworn.²

*These experiments were completed in December, 1915.

He says that after the initial phenomena of excitation from small doses, and after brief administration, with increasing action of the anæsthetic, there are phenomena of depression, becoming more and more noticeable, which, apparently, are able to lead to a complete stand-still of life. Lyman⁶ says that in consequence of certain factors to be named later, "the vascular pressure in the arteries, which may have exhibited an increase at the outset of inhalation, displays a decided fall. This diminution is much less noticeable when ether is used in place of chloroform." Potter⁷ admits that if ether be administered long enough, after the cerebral functions are suspended, the lower centres in the medulla, carrying on the processes of respiration and circulation, are paralyzed. Gwathmey⁸ says there is slowing of the pulse and a slight fall of blood-pressure during the later stages of anæsthesia, or when toxic amounts are administered.

While there is general agreement as to the status of the blood-pressure in the later stages of anæsthesia, it is certainly possible, with proper administration of the drug, to maintain deep anæsthesia for certain periods without the usual concomitant phenomenon, *i.e.*, lowering of blood-pressure. Meyer and Gottlieb⁹ say that general observations on animals show that "when ether is used the blood-pressure may long remain at normal level." After summing up the conclusions of workers on this subject, an editorial in the *Journal of the American Medical Association*¹⁰ concludes by saying, "It is well known that ether, when administered properly for a moderate length of time, does not lower the blood-pressure." . . . "With ether the blood-pressure may remain constant for several hours"

Concerning the causes of the lowered blood-pressure in the later stages of ether anæsthesia, all writers are not agreed. There are no investigators who throw the blame on the heart alone. The consensus seems to be that the combined effects of the anæsthetic on both heart and vasomotor mechanism constitute the blood-pressure lowering factors. Of the three great factors in the maintenance and stabilizing of the blood-pressure, the rate, strength and volume of the ventricular contractions and the peripheral resistance, as represented by the arteries of the peripheral and splanchnic circulation, are the principal entities.

Lyman⁶ says the blood-pressure is lowered because of a relaxation of the vascular canal, opposed to a heart that beats less energetically. The combination of these two pressure lowering conditions brings about the result noted.

Gwathmey⁸ says that ether becomes a cardiac depressant in the later stages of anæsthesia, or when a toxic amount of the drug has been

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given. This, with a depressing effect on the vasomotor centre, which brings about a general arterial dilatation, causes the fall of blood-pressure.

Cushny,¹¹ in commenting on the conditions of the phenomenon, states that "the fall of blood-pressure in prolonged ether anæsthetic is due mainly to the weakness of the heart, along with a dilatation of the peripheral vessels."

Some do not agree that the conditions of both heart and arteries are to blame. Hewitt¹² thinks the fall of blood-pressure, met with under certain anæsthetics, is due to direct vascular dilatation, while Sollman¹³ says that the condition is due partly to a direct action of ether on the vasomotor mechanism, but is aided by the asphyxia.

Attacking the problem from the standpoint of anatomical changes in the brain cells of dogs subjected to long-continued ether anæsthesia, Butler¹⁴ in this laboratory demonstrated unvaried cell changes of depression as the end result. The nervous control of both the heart and the vasomotor mechanism would thus more probably be involved, though this does not exclude the direct action on the heart and vessels.

The conclusion of the majority of investigators that the hypotaxis under question is conditioned by the combined depressing effects of the anæsthetic on the heart and vasomotor mechanisms is in accord with the conclusions of this laboratory.

The Condition of the Peripheral Arteries.—There seems to be no disagreement as to the dilatation of the peripheral arteries during ether anæsthesia. Weber¹⁵ remarks that after general ether anæsthesia there are evidences of perverted vasomotor functioning, lasting for several days. Lyman⁶ says the inhalation of considerable quantities of a powerful anæsthetic results in paralysis, and soon produces relaxation of the vascular canal. Muehlberg and Kramer¹⁶ assign vasomotor paralysis as one of the causes of death under ether. Gwathmey⁸ states that there is a general arterial dilatation, agreeing with Cushny¹¹ and Sollman.¹³

This arterial dilatation is so marked that there is a perceptible increase in hemorrhage from severed arterioles during an operation. Luke¹⁷ states that under ether anæsthesia ". . . incised parts are often very vascular, the surgeon not uncommonly remarking on the free hemorrhage."

Oliver¹⁸ graphically demonstrated the actual increase in size of the radial artery during ether anæsthesia. After many experiments with his clever arteriometer he concluded that ether invariably increases the caliber of the arteries.

The Origin of the Dilatation.—There is not so much agreement concerning the origin of the dilatation. There seems to be a preponderance of evidence that it is conditioned by the action of the anæsthetic on the vasomotor centre.

Chief of those maintaining that the vasodilatation is not due to the action of the anæsthetic on the vasomotor centre, is Cushny¹¹, who says: "Ether seems to have little or no direct action on the vasomotor centre, but the dilatation of the skin vessels indicates that it excites the vasodilator function." Hewitt¹² specifically states that according to certain researches "fall of blood-pressure, met with under certain anæsthetics, is referable rather to direct vascular dilatation than to dilatation of central nervous origin."

On the other hand, Weber¹⁵ notes that the central vasomotor mechanism is extremely sensitive to injurious influences brought by the blood, and that ether exerts these injurious influences to a degree about midway between that of local anæsthesia and chloroform. Meyer and Gottlieb⁹ say that "Large doses of narcotics or other central depressants cause gradual diminution of, and final general paralysis of, the vasomotor centres." Potter⁷ agrees with this view.

THE PROBLEM

The purpose of this investigation was to demonstrate graphically the actual changes in the condition of the peripheral circulation and in blood-pressure accompanying long-continued ether anæsthesia, and the relation which the vasomotor changes may have to the blood-pressure. The results will be analyzed along with other understood phenomena, to see what correlation there may be between the sum of the conclusions and any one of the theories of causation cited above. It is also necessary to answer the question as to what neutralizing or other effect the anæsthetic may have in other experimental operations requiring mechanical technic, the trauma from which usually brings about the symptom-complex recognized as shock. This series of experiments should give a fair working hypothesis, therefore, of the relation between shock and depression.

It is proposed, therefore, to show (1) that there are definite changes in the condition of the blood-vessels of the periphery closely following long-continued ether anæsthesia, the term periphery to mean the whole of the legs, and the body musculature with skin; (2) that there are certain definite conditions of blood-pressure during the experiment; (3) and that these changes of vasomotor control and of blood-pressure are

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in direct relation to each other. Further, it is proposed (4) to outline the direct relationship between shock and depression, and to show (5) what basis there is for accepting any one of the theories cited in the introduction.

METHODS OF EXPERIMENT

A uniform method of administering ether was necessary, as well as a reliable method of graphically demonstrating the variations of the vasomotor mechanism, and the changes in blood-pressure.

The ether was administered through a tracheal cannula, connected by a rubber tube to a glass ether bottle one liter in capacity. On inspiration the outside air was conducted below the surface of the ether by a glass tube open at both ends and thrust through the cork, and drawn up in bubbles through the ether. By raising or lowering this intake tube, the concentration of ether vapor in the air supplied to the lungs could be very well regulated. Most of the expired air was thrown out through a one-way valve between the trachea and the ether bottle.

In order to avoid the effects of acapnia¹⁹, the rubber tube of large diameter between the ether bottle and the tracheal cannula was lengthened or shortened as required, thus constituting a type of rebreathing apparatus. The animal used was allowed to die at the end of the experiment, and it was not thought necessary to warm the ether vapor.

It is not necessary to repeat the description of the method of graphic demonstration of the vasomotor and blood-pressure changes. The same form of leg plethysmograph, recording through a water system manometer, was used as described in a former paper¹. The blood-pressure tracing was taken from the carotid artery connected with an ordinary mercury manometer.

DESCRIPTION AND EXPLANATION OF EXPERIMENTS

Dogs weighing from 6 kg. to 10 kg. were used. No drugs such as curare and morphine were used, as in the experiments referred to before. After the dogs were anæsthetized, the dissection in the neck was made the first procedure. One of the hind legs was then shaved from the knee down and the plethysmograph was adjusted. This technic usually required about one hour's time, consequently the record of the changes begins after the dog had been under the anæsthetic for this period; therefore, the first effect of the anæsthetic on the vasomotor mechanism and blood-pressure is not recorded.

For the first hour the drum was allowed to move a little at intervals of five minutes each. At the end of the first hour of the record, the

observations were taken every fifteen to thirty minutes. By close attention for a short time the air intake tube and the rebreathing tube could be adjusted so that the subject would get a steady supply of anæsthetic vapor, heavy enough to maintain the third stage of anæsthesia. The experiments were allowed to run as long as six hours, unless terminated by some untoward incident.

After the death of the animal, the mechanism was calibrated and the records made permanent by fixing in shellac¹.

Of the many records secured, several were discarded because of mechanical errors, but these all showed the typical graphs.

Six of the graphs have been analyzed in the accompanying table.

DISCUSSION OF EXPERIMENTS

The shortest experiment was one hour in length, the longest one, six hours and ten minutes. Three experiments were six hours, or over, in length, and two were over three hours in duration.

The Blood-pressure.—In the three shorter experiments the blood-pressure was from 19 to 70 mm. Hg lower at the end of the experiment than at the beginning. In the three longer experiments the blood-pressure was from 12 to 21 mm. Hg higher than at the beginning. In four cases out of six there was a slight fall of blood-pressure at the end of the first half hour. Two of these showing such a fall (Experiments 10 and 12) had a continuous fall to death, while Experiments 3 and 8 showed a slight gradual rise to death. Experiment 9 showed 16 mm. Hg rise at the end of the first half hour, but ended finally in a 19-mm. fall. Experiment 11 showed a 16-mm. rise at the end of the first half hour and ended in a total rise. In all cases there was a relative slowing of the heart, progressing towards the end of the experiment. Time records were not kept. Also there was a marked increase in amplitude of individual beat which seemed to vary with the slowing of the rate.

The Vasomotor Reactions as Indicated by the Leg Volume.—In five to forty minutes after the adjustment of the plethysmograph a change in leg volume was noted, three cases showing a vasodilatation, and three showing a vasoconstriction. At the end of the first half hour there was a general vasodilatation shown except in one case. At the end of the first hour (the second hour of anæsthesia) all cases showed a marked vasodilatation, which condition slowly increased, with occasional periods of vasomotor recovery, until at death there was a total increase of leg volume of 2 cu. cm. to 18 cu. cm.

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TABLE I
DATA OF EXPERIMENTS

Number of experiment	Length of experiment in hours	Time in minutes elapsing before change of leg volume	Character of volume change			Total increase of leg volume at end of experiment in cubic centimetres	Blood-pressure in mm. Hg				Total fall of blood-pressure	Total rise of blood-pressure	Periods of recovery of volume
			First half hour	Second half hour	Remainder of experiment		At end of		At start of experiment	At end of experiment			
3	61/12	40 rise	No change	2 1/4 c.c. increase	Irregular increase	8.5	104	112	108	122	...	14 mm.	.5 c.c. at end of 2 hours. Rapid recovery. .3 c.c. at end of 2 1/2 hours. Recovery in 10 minutes. .5 c.c. at end of 3 hours. Recovery rapid.
8	61/6	5 rise	2.5 increase	3.5 increase	Irregular increase	14.5	96	96	103	124	...	21	.5 c.c. at end of 40 min. 1.5 c.c. at end of first hour. .5 c.c. during second hour. 3. c.c. during fifth hour. 1. c.c. during sixth hour.
9	31/4	10 slight fall	1.5 increase	2.5 increase	Slow, regular increase	7.5	98	108	82	63	19	...	1 c.c. fall below 0 in 10 minutes. 1.5 c.c. at end of first hour.
10	1	5 fall	1 increase	2 increase	Slow, regular increase	2	140	78	148	78	70	...	1.5 c.c. fall below 0 in 5 minutes. Slight recovery at end of first half hour.
11	6	10 fall	4.5 increase	8 increase	Irregular increase	18	78	62	62	74	...	12	.5 c.c. fall in 10 minutes. Rapid increase for 25 minutes. 1 c.c. recovery at end of 2 hours. No increase last 1 1/2 hours.
12	4	5 rise	4 increase	7 increase	Slow, regular increase	12	140	120	148	85	63	...	

All cases but one showed a steady progressive increase of the vasodilatation up to the very last half hour of the experiment. Experiment II, which ran six hours, showed the limit of vasodilatation in four and one-half hours, with no recovery during the last one and one-half hours.

GENERAL DISCUSSION AND CONCLUSIONS

Ordinary third-stage ether anaesthesia, prolonged beyond one hour, always results in more or less marked vasodilatation in the periphery. This is a progressive change, more or less regular in character, increasing directly in proportion to the lengthening time of administration. In most cases the limit of vasodilatation is not reached within seven hours after the beginning of the anaesthetic, but occasionally the extreme of the condition may be reached after a shorter administration of the drug.

If the endeavor be made to explain the response of the vasomotor mechanism as being conditioned by the local action of the ether on the peripheral vasomotor mechanism, it is necessary to assume that the results are to be explained by the variation of the normal degree of vasoconstriction-dilatation present in the periphery at the inception of the experiment. It is well known that there is a more or less constant tonic activity of the peripheral vasomotor function in the normal animal. It is conceivable that there may be times when the peripheral arterioles are dilated or contracted to such an extent that any further dilatation or constriction would be impossible; but normally there is a tonic balance of function, the variation being noticeable only within the narrow limits set by the requirements of the mechanics of circulation.

Granting that the degree of dilatation or constriction of the peripheral arteries at the beginning of the experiment varies with different individuals, it can be safely said that the variation is not great enough to be considered as limiting or conditioning the present graphic result.

If an explanation is based on the hypothesis that the vasomotor centre is the variable factor in bringing about the vasomotor change, one may say that the variation of response is directly dependent upon the anatomical-functional changes in the nerve cells of the vasomotor centre produced by ether. This centre cannot escape such changes as are demonstrated by Butler¹⁴ as the general effect of ether, as hereafter explained.

In half the cases cited there is a decided fall in blood-pressure. It is noted also that the time length of the experiment was in these instances much shorter than others showing different net end results. The

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three tabulated experiments, running six hours or more, showed the blood-pressure to be slightly more than maintained. There is then a disturbance of the normal physiologico-mechanical relation between two of the three great blood-pressure controlling factors, *i. e.*, the rate and strength of the heart, and the peripheral resistance in the arteries. This disturbed relation is shown by the behavior of the blood-pressure in three of the cases. There is a fall of blood-pressure as an end result in these three cases. This, of course, is what would be expected in the presence of such great vasodilatation.

The normal tone and resistance in the arteries have been altogether or partly destroyed in all cases, and the blood-pressure lowering effect of this one factor, obtaining throughout all of the periphery, must be tremendous. Why, then, is there in half the cases a decided and fatal fall in blood-pressure, and in the other half a decided maintenance of the tension? It is evident that the question must be answered by considering the normal compensatory reaction to the blood-pressure lowering tendency of the peripheral dilatation on the heart. While the heart did not increase in rate in any instance, there was a decided increase of ventricular output, an increase great enough to overcome the hypostatic effect of the peripheral dilatation: the blood-pressure was maintained and even raised a little. It is evident that if the heart fails to show this compensatory reaction, because of organic disease, or too early response of the nervous centre to the effect of the anæsthetic, the blood-pressure must fall, as it did in the three cases noted.

In considering the three cases showing the failure of cardiac compensation, it is permissible to argue that any means of preventing or overcoming the peripheral vasodilatation would have resulted in maintenance of blood-pressure.

In a former paper¹ it was clearly shown that trauma to the exposed intestines brings about a certain vasomotor response in the blood-vessels of the periphery, and this response is a reflex vasoconstriction. Interesting to note also is the fact that in seven experiments, from 45 to 165 minutes in length, the blood-pressure was either nearly exactly maintained, as in two cases, or was higher at the end of the experiment than at the beginning, as in three cases. Only two cases showed a fall of pressure at the end, and these results were obtained from dogs living less than an hour after the beginning of the trauma, the leg volume tracing in both cases showing little or no vasoconstriction to offset the heart failure.

In the light of what we have learned from all experiments it is safe to say that in the ordinary major operation, with ether as the

anæsthetic, a moderate amount of excitation from handling is a helpful factor. There can be no question that there are occasions at times, with the patient on the verge of syncope from ether depression, when a vigorous cutaneous or visceral irritation would restore the vasomotor tonus, resulting in a beneficial reflex rise in pressure. Bearing on this generalization, we repeat the notes of Experiment January 31 in a former paper referred to above¹: "In one experiment (January 31) the handling of the intestine immediately brought about a slight fall in the volume of the leg with at first a fall then a rise in blood-pressure. When the handling ceased for two minutes the leg volume went up, the blood-pressure remaining about normal. When the manipulation was taken up again there was a fall in volume. These transitory changes in leg volume and blood-pressure went on through the whole experiment (52 min.), the general trend of the volume being downward, so that at the end of the experiment there was a permanent fall of 5 cu. cm." This case, on the experimental side, shows the sensitiveness of the vasomotor mechanism to reflex stimulation, and it is clear how such a reflex stimulation, in proper time and moderation, may very well become a remedial measure in impending ether death. Weber¹³ recognizes this principle when he treats by alternate hot and cold douches the disturbances of the vasomotor mechanism after general anæsthetics.

It is interesting, indeed, to read of Kirstein's four cases²⁰, the report of one of which has been abstracted²¹. One case of cessation of the manipulation of the peritoneum during a laparotomy arrested the respiration and heart beat. He theorizes that the amount of anæsthetic required depends on the intensity of the irritation from the operative procedures, a certain amount of anæsthetic balancing a certain amount of irritation. If this irritation stops suddenly, the anæsthetic then makes its influence felt more on the general system, so that anæsthesia slides into the danger phase. The narcosis-asphyxia came on suddenly when the operator had finished with his investigation and manipulation of the peritoneum.

In the case just cited it is evident that the sensory stimulation from the manipulation of the peritoneum was the prop which supported the function of the centres of respiration and circulation. The stability of function of the vital centres in the medulla under such conditions is, therefore, more apparent than real.

Reasoning from the same facts toward the same end, namely, the safety of the patient, Oliver¹⁸ says, "Inasmuch as I have shown that operative procedures are apt to throw an increased strain on the heart

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and great vessels by causing extensive contraction of the middle and smaller sized arteries, it would seem to follow that those anæsthetics will be the safest that maintain the heart's action and the fullness of the arteries."

As being of interest on this topic, one of Henderson's conclusions is here given: "Morphine and complete anæsthesia counteract the development of shock by quieting the respiration" ²².

So we come naturally to the fundamental question of excitation versus depression. Verworn early defined these as "quantitative opposites, activity being an increase, depression a decrease in the intensity of vital phenomena." Anatomically, so far as concerns the analysis of the function of the nerve cell, this is supported by actual volumetric comparison (Dolley ²³).

These processes depend upon the fundamental property of irritability of protoplasm. To show the scope of this property, there are only two other fundamental ones concerned in dynamic reactions, reproduction (division of cells) and nutrition. Function of the nerve cell is deduced as the manifestation of its irritability which has been determined by specialization, anatomic differentiation (Dolley ²⁴). The stimulus to the irritability, as Verworn defines it, is "Every alteration in the external vital conditions." Stimuli, therefore, are either excitant or depressant. In respect to irritability, nervous phenomena can be only referable primarily to excitation or depression, or both.

Excitant stimuli produce function in the usual sense. Looking now only at end results, if excitant stimuli are excessive, there results a using up of substance faster than it can be replaced, which in the earlier stages is an organic fatigue, and which leads to eventual organic exhaustion. Depressant stimuli produce depression, the lowering or blocking of function, its diametric opposite. In moderate degrees depression corresponds to fatigue of another sort, such for example as occurs in the accumulation of waste products, or the blocking of function may be complete.

There are then two kinds of fatigue, from excitation and depression. Both may lead to an absolute condition, either complete exhaustion or depression. But, though the end result is reached by entirely different processes, its effect is identical in a complete functional incapacity. An exhausted cell is just as incapable of function as is a depressed cell.

To understand the effect of ether, therefore, one must keep in mind its relation as a stimulus. It belongs to that more common group which are only different in that they combine excitation and depres-

sion, first exciting, then depressing. The depression is its essential effect.

To understand the primary effect of an operation, it must be kept in mind that the primary stimuli are excitant only, being mechanical. Their effect then is wholly excitatory, leading to overactivity, and, if long enough continued, to more or less of fatigue, and possibly to exhaustion. So the primary effect of shock is overfunction, though it is to be noted that this effect is only displayed outwardly according to the body mechanism which permits its display. Anatomically it is a general phenomenon for the nervous system.

It is evident that when sensory stimuli and the anæsthetic are exhibited together as in any ordinary surgical operation there is one period when the excitation from the surgical technic and the depression from the drug are pitted against each other, to the good of the patient. There is a later period when the two antagonists become allies in effect, and total functional incapacity and death come about quicker than when only one agent has been at work.

It has been concluded, therefore, that the symptom-complex known as post-operative shock is a combination of the effects of excitation and depression and varies directly with the algebraic sum of these two factors (Dolley²⁵).

Proof that the phenomenon of vasodilatation rests entirely on the extent of dilation or constriction in the arteries at the inception of the experiment rather than on the central reaction, demands a graphic demonstration of the absolute vasomotor changes taking place during the first hour of anæsthesia. To proceed to base conclusions on the changes noted *after* the first hour of anæsthesia is unsound practice. There is every reason to believe that when the inhalation of ether is begun there is a condition of increased tonicity of the vasomotor system. The extreme excitement accompanied by the heightened blood-pressure are sufficient grounds for assuming that there is a heightened activity of the vasoconstrictor function. It is probable, therefore, that in the ordinary ether anæsthesia, conducted into the third stage, the vasomotor response runs through phases of excitation into depression. Granting, however, that some part of the result is peripheral in origin, against which there is no objection, the essential effect must be central, simply from the difference in degree of irritability in one against the other, the smooth muscle cell against the nerve cell.

"Ether anæsthesia produces certain definite anatomical changes in nerve cells of dogs. The changes are first those of mild activity and later there are superimposed changes of depression depending in se-

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verity upon the duration of the anæsthesia. The changes first make their appearance microscopically in one and one-half to two hours. Anæsthesia of two to six hours produces a moderate depression, one up to eight hours a marked depression, and one of more than eight hours a profound depression, with the beginning of necrobiosis.

"The severity of the anatomical changes in the nerve cell appears to be in direct relation to the length of the anæsthesia, allowances being made for individual variations.

"The changes vary in degree in animals of the same species kept under the same form of anæsthesia for the same length of time." (Butler.¹⁴)

It is true that no one has ever studied the anatomical changes in the cells of the vasomotor centre in the medulla after prolonged overstimulation, or after ether anæsthesia. Indeed, it is impossible even to locate these individual functionally specialized cells with any degree of accuracy.

We may base our argument on Dolley's²⁴ conclusion: All nerve cells go through the same quantitative sequence of changes in their function, exhibiting therein a unity of mechanism. Because of this unity of mechanism deductions from any single type of cell which relate to the fundamental quantitative principle may be applied to all.

SUMMARY

1.—Ordinary third-stage ether anæsthesia prolonged beyond one hour results in more or less marked vasodilation in the periphery. This is a progressive change, more or less regular in character, increasing directly in proportion to the lengthening time of administration. In most cases the limit of vasodilatation is not reached seven hours after the beginning of the anæsthetic, but occasionally the extreme of the condition may be reached after a shorter administration of ether.

2.—There is a direct relationship between the condition of the vasomotor control and the blood-pressure.

3.—The end result of ether depression is loss of function. The symptom-complex, known as post-operative shock, is a combination of the effects of excitation and depression, and varies directly with the algebraic sum of these two factors.

4.—The vasomotor centre is the variable factor in bringing about the vasomotor change; the variation of response is directly dependent upon the changes in the vasomotor centre produced by ether.

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BLOOD-PRESSURE AND PROSTATECTOMY

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THERE is a vital and definite relationship between the vascular system and the renal functioning, which is measured by the blood-pressure. And as old age and obstruction of the lower urinary tract greatly raise this pressure, we view with interest anything which suddenly decreases it, as serious complications often result.

Effects of Chronic Prostatic Obstruction on the Blood-pressure.—Outside of the dilation and hypertrophy of the bladder and ureters, resulting from chronic prostatic obstruction, we have increased difficulty of renal excretion which requires a greater blood-pressure to filter the blood through the kidneys. This naturally calls for a greater blood-pressure, so we are not surprised to find a high pressure (above 150 mm. Hg) in most cases of prostatism. It is not uncommon to also find a polyuria, a low specific gravity and the absence of albumen. The greater the obstruction and the longer it has endured, the higher the blood-pressure is the rule.

Effect on the Blood-pressure of Suddenly Removing the Urinary Obstruction.—Whether this is accomplished by a urethral catheter, cystotomy or suprapubic puncture, the results are all the same. Within a few minutes the blood-pressure falls from ten to even one hundred millimetres of mercury. As a result of this suddenly lowered pressure, the force through the renal filters is also decreased, decidedly less urine is excreted, the specific gravity rises, and infrequently casts and albumen appear, with all the symptoms of an acute nephritis. This change which takes place in from 25 to 50 per cent. of operative prostatitis, a change from active, albumen-free kidneys to a condition of anuria, casts and albumen, I have called hidden nephritis. It is the real cause of the high mortality of prostatectomy; not shock or hemorrhage.

It is most essential, therefore, to watch closely the blood-pressure readings, and for the appearance of albumen and casts after relieving urinary back pressure. At the first signs of a hidden nephritis, active anti-uræmic treatment must be instituted at once.

I can do no better than report in detail a few of my own prostatectomies and suggest to those who wish confirmation of this interesting and serious change, to make a few observations of their own, on their next prostatic subjects.

CASE I.—*History*: Age 64, retired from business. Health fair. Cardiovascular System—Mitral and aortic lesions, good compensation. Blood-pressure, 140 mm. Hg.

Urinary System.—Residual urine, 12 ounces, clear, low specific gravity, no albumen, no casts. He has been troubled a long time with prostatic obstruction. Rectal palpation reveals a large gland, smooth, fairly soft, no nodules, left lobe prominent.

Operations.—November 11, 1915, Drs. Horsfall and Gardner performed a suprapubic cystotomy, employing 2 per cent. novocaine. The bladder was distended and had thick walls; a large fibroma of the central lobe blocked the vesicle urethra. The blood-pressure fell from 140 mm. Hg to 105 mm. Hg, immediately after opening the bladder. November 16, 1915, five days later; an enucleation was accomplished under spinal anaesthesia. A good recovery resulted.

CASE II.—*History*: Age 64, farmer. Height 5 feet 11 inches, weight 160 pounds. Has had a large right inguinal hernia for years; no serious illness or accident.

Cardiovascular System.—The pulse is full, strong, 68, regular. Arteries moderately sclerosed. Blood-pressure 260 mm. Hg.

Urinary System.—He has difficulty in voiding for past five years; lately urine dribbles constantly, no stream at all. Pain over the distended bladder. The urine is pale, specific gravity 1.010, very clear, free of sugar and albumen; cylindroids are present. Rectal exploration, discovered a large soft prostate, about three inches long; external, a few mucocutaneous hemorrhoids.

Operation.—January 24, 1916, suprapubic cystotomy, using urea and quinine anaesthesia, preceded one hour with morphine, $\frac{1}{4}$ grain; the patient was quite drowsy. After ligating several large vessels in the bladder wall and inserting a purse-string suture, the bladder was opened. The blood-pressure fell immediately from 260 to 150 mm. Hg. From then on the quantity of urine excreted was gradually diminished, the specific gravity rose from 0.010 to 1.028, and albumen made its appearance. The patient soon refused to eat, and two days later started to vomit, refusing even water. The wound was clean, with no bleeding, the temperature became subnormal, the blood-pressure continued to fall; death from uraemia occurred at 1:30 P.M., January 28, 1916, four days after relieving the intravesicle pressure, by a simple drainage.

CASE III.—*History*: Age 70, retired from business. He stated that he had always been well. Recently there has been loss in weight, slight fever, increase in pulse rate and sweats occur at night. He is 5 feet 4 inches tall and weighs 135 pounds.

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Cardiovascular System.—Pulse 84, regular, vessels sclerosed. Blood-pressure, (a) systolic, 140 mm. Hg, (b) diastolic, 100 mm. at 3 P.M.

Urinary System.—Six years ago he first experienced difficulty in voiding. His urine has contained pus and blood for some time. Residual urine of 300 c.c. blood tinged. Sound No. 24 F. into bladder, capacity of latter 700 c.c. By rectal palpation, a mild enlargement of both lateral lobes of prostate made out. It was mechanically impossible to insert a cystoscope. Urinalysis, specific gravity 1.010, albumen faint trace (due to blood present), no sugar, many pus cells, red blood-cells, plate epithelium, a few staphylococci and many bacilli.

Operations.—November 10, 1915, under ether anæsthesia, a suprapubic prostatectomy was performed. After inserting a purse-string suture, the bladder was opened; the middle lobe nourished a fibroma, three inches in length and resembling a pear. The prostatic pouch was foul, with pus and mucus. The blood-pressure fell from 140 mm. Hg to 120 mm. Hg. Two weeks after the operation he had two intravesical hemorrhages from the prostatic capsule; this was packed. Good functional recovery.

CASE IV.—History.—Age 84, widower, born in Canada of Irish and English parents; by trade a shoemaker. Always enjoyed excellent health. Height 6 feet; weight 170 pounds.

Cardiovascular System.—Pulse full, strong, vessels sclerosed. Blood-pressure 220 mm. Hg.

Urinary System.—For some time past has had difficulty in voiding, and past three days, has had complete retention, catheterization being necessary. Strictures in membranous urethra. 900 c.c. of dark concentrated urine obtained with catheter; specific gravity, 1.025, no albumen, no casts. Rectal palpation made out a slightly enlarged prostate of soft consistency.

Operations.—December 20, 1915, suprapubic cystotomy, novocaine solution. After relieving the bladder of its tension, the blood-pressure dropped from 220 to 190 mm. Hg. December 24, 1915, prostatectomy was performed, using Babcock's intraspinal solution. After waiting twenty-five minutes, the anæsthesia was so slight, chloroform was employed. The lateral lobes were of moderate size and a small fibroma of the median lobe was removed. No shock. He made a perfect functional recovery.

CASE V.—History.—Age 64, contractor, born in New York State, Dutch descent. Mother died of carcinoma of bowels and father of cholera. The patient has lived an active out-door life, chiefly manual labor. He remembers having had the following illnesses: mumps, measles, scarlet fever, diphtheria, fever and

ague, a bite by a copperhead snake and two attacks of gonococcus infection. Height 5 feet 9 inches, weight 136 pounds.

Cardiovascular System.—Pulse full, 64, regular; vessels, moderate sclerosis. Heart, no murmurs; sounds not clear as there is no snap to the valves. Blood-pressure is 140 mm. Hg.

Urinary System.—He has had difficulty in voiding for the past few years, having "to pump" to start the urine; small stream, frequency at night. The voided urine is clear, specific gravity 1.020, albumen, sugar and casts absent. Residual urine, 100 c.c. clear. Sound No. 24 F. was obstructed in the prostate.

Operations.—February 26, 1916, using quinine infiltration, a suprapubic cystotomy was performed. The blood at the start was 137 mm. Hg. after opening the bladder, 155 mm. Hg. Two days later, at noon, the pressure was 117 mm. Hg. and the pulse slightly intermittent, dropping every sixth beat. Urine greatly decreased, specific gravity, 1.029, albumen, 9 grams or 75 per cent. by bulk, many casts, both hyaline and granular. February 29, 1916, supraprostectomy, very light chloroform anæsthesia, lateral lobes and isthmus enucleated in one mass. Capsule packed. Nephritis was combated with potassium acetate, digitalis and pulverized kidney gland. One month later, patient came to my office, entirely healed. Urine clear, faintest trace of albumen, no casts and a few cylindroids. Blood-pressure, 3.30 P.M., systolic 110 mm. Hg, diastolic 80 mm. Hg.

CASE VI.—History.—Age 73, retired from business, born in Maine. Lived a temperate life. General health good; failing a little in last two years.

Cardiovascular System.—Heart rate, 72, every 15th beat intermits. Blood-pressure, 10.30 A.M., in bed, (a) systolic, 148 mm. Hg; (b) diastolic, 90 mm. Hg.

Urinary System.—Troubled for past five years with obstructed urination; stream slow, hesitating, twisted, no force. A number of times bleeding from meatus. Past few days, unable to void, catheter employed. Pain in bladder intense and urine quite bloody. Rectal palpation, discovers a large, soft prostate. Urine, 36 ounces in twenty-four hours, blood-tinged, specific gravity, 1.024, albumen, faint trace (blood), sugar absent, no casts.

Operations.—March 28, 1916, suprapubic cystotomy, 1 per cent. novocaine. Pressure before opening bladder, systolic, 150 mm. Hg; after, 140 mm. Hg. Three days later, 9:30 A.M., urine, 1.030, albumen, heavy ring; hyaline and granular casts. Pressure (a), systolic 128 mm. Hg, (b), diastolic 70 mm. Hg. April 1, 1916, prostatectomy while under nitrous oxide anæsthesia.

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Two large lobes enucleated, weight $4\frac{1}{2}$ ounces. There was slight oozing in spite of packing in prostatic bed; stopped immediately with 10 c.c. horse serum. The drugs to combat the nephritis were stopped on account of gastric irritability. Everything went smoothly until the fourth day, hiccough started, the pulse increased in rate, the urine stopped secreting, the blood-pressure fell steadily, coma set in and lasted for twelve hours. Death from uræmia.

CASE VII.—History.—Age 58, laborer, Scotch descent, born in Canada. He has lived a hard life, chiefly manual labor; wandered extensively. Has never been robust. Height 5 feet 11 inches; weight 155 pounds. No serious illness.

Cardiovascular System.—Pulse 74, regular rhythm, volume large; vessels moderately sclerosed. The systolic blood-pressure is 250 mm. Hg.

Urinary System.—There has been difficult voiding for several years and at times the stream is almost shut off; there is frequent micturition at night. The urine is clear, 1.022, and free of albumen, sugar and casts. A finger in the rectum feels a slightly large prostate. Residual urine, 45 c.c.

Operations.—April 22, 1916, a suprapubic cystotomy under urea and quinine anæsthesia. Pressure before opening the bladder, 243 mm. Hg; immediately afterward, 220 mm. Hg. Two days later, patient had a coated tongue, a uriniferous breath, pulse 104, blood-pressure (a) systolic, 170 mm. Hg (b) diastolic, 120 mm. Hg. Anti-uræmic treatment instituted. April 25, 1916, urine, albumen heavy ring, hyaline casts, diminished amount. Prostatectomy under nitrous and oxygen anæsthesia. From then on, it was a fight with uræmia, excellent nursing winning out. The last urinalysis, June 8, 1916, specific gravity 1.020, clear, no albumen, no casts. Blood-pressure 180 mm. Hg.

Some time ago, D. C. Balfour of the Mayo Clinic, in a paper on "The Care of Surgical Patients," spoke of the great value of preparatory treatment in prostatic cases. The preliminary drainage of the bladder clears up the urine and lowers the blood-pressure, he asserts. Crenshaw states that in the last fifty cases of prostatectomy in the Mayo Clinic, preliminary drainage has been used, with an average drop in blood-pressure from 166 to 145 mm. Hg.

Recently, D. F. Cameron, of the Brady Urological Institute of the Johns Hopkins Hospital, reported some new studies of renal secretion, entitled "Variations in Renal Function Dependent on Surgical Procedures," which is exceedingly interesting. Little by little, the haze is lifting, and we understand better, the estimating of renal secretion, normal and abnormal. Cameron mentions the functional changes

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following the relief from back pressure of the urine; this is accomplished by a drainage of the bladder, by an in-lying catheter; my own experience has shown that there is just as great a fall of blood-pressure on catheterizing an obstructed bladder as there occurs with a cystotomy. This is probably the reason we have always been warned never to completely empty a distended bladder and why shock and even death has followed this simple operation of catheterization.

TABULAR ANALYSIS OF THE SEVEN CASES.

	Operation	Primary Blood- Pressure.	Immediate Blood-Pressure- Fall.	Events
I.	Preliminary cystotomy.....	140	35 mm. Hg.	Uneventful recovery.
II.	Preliminary cystotomy.....	260	110 mm. Hg.	Nephritis developed, death 4th day, uræmia.
III.	Prostatectomy	140	20 mm. Hg.	Good recovery.
IV.	Preliminary cystotomy.....	220	30 mm. Hg.	Uneventful recovery.
V.	Preliminary cystotomy.....	137	22 mm. Hg.	Nephritis developed, recovery.
VI.	Preliminary cystotomy.....	150	10 mm. Hg.	Nephritis developed, death 4th day.
VII.	Preliminary cystotomy.....	250	30 mm. Hg.	Nephritis developed, recovery.

NOTES AND CONCLUSIONS

1.—There is a definite physiologic relation existing between the blood-pressure and the filtration in the kidney glands.

2.—That a high blood-pressure is purely compensatory, and necessary to the individual in which it is found, to maintain a normal excretion of urine.

3.—That any sudden and permanent lowering of the blood-pressure by radical or heroic measures is often a fatal procedure.

4.—That a persistently high blood-pressure, even in the absence of albumen and casts, usually means a hidden nephritis.

5.—That a chronic prostatic obstruction produces serious back pressure changes in the ureters, the kidney substance, the kidney circulation and the excretion of urine.

6.—That a sudden relief of this intravesical pressure produces an immediate fall in blood-pressure, from 20 to 100 mm. Hg.

7.—That if the pre-operative blood-pressure is much over 150 mm. Hg, the risk of a cystotomy or prostatectomy advances rapidly.

8.—That compensation between the blood-pressure and the urinary excretion will take place if the pressure is not abnormal and will occasionally in a high pressure where there is unusual vitality or compensatory power.

FURTHER OBSERVATIONS ON THE ANATOMY OF THE SINUS FRONTALIS IN MAN

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It is a well established fact that the anatomy of the adult frontal sinus varies greatly—there is no constancy in size, shape or type. The right and the left sinuses are usually asymmetrical and either or both may be present in duplicate or triplicate (the writer has observed even as many as four frontal sinuses on one side, each with an independent communication with the *cavum nasi*). There is also considerable variation in the manner of communication of the frontal sinus with the *cavum nasi*; this is, of course, in accordance with the embryology of the sinus. Agenesis of the sinus has also been reported.

It is not the purpose of this communication to enter into a detailed discussion of the above points. The reader is referred to earlier papers by the writer.¹ Here reference will be made to extremes in development of the sinus frontalis recently encountered. Clinically these variations must be of considerable importance and an appreciation of them will doubtless aid the clinician in clearing up some obscure cases.

Brühl in a study of the sinus frontalis found the capacity of the combined sinuses (right and left) to vary from 6 to 16 c.c. The writer recently encountered two cadavers in which the frontal sinuses were of enormous size, far exceeding Brühl's maximum. So far as I have reviewed the literature, these two cadavers are unique as regards the capacity of the frontal sinuses.

The first specimen is that of an adult male (Fig. 1). The skull presents three frontal sinuses, one on the right side and two on the left. The three sinuses communicate with the frontal recesses of the middle nasal meatus. The whole of the orbital (horizontal) portion of the frontal bone is pneumatized. Indeed, the frontal sinuses are not confined to the frontal bone: Laterally and dorsally they extend into the great or temporal wings (*alæ magnæ*) and dorsally and medially into the small or orbital wings (*alæ parvæ*) of the sphenoid bone. The medial one of the two left sinuses extends into the

¹ J. Parsons Schaeffer: Univ. of Penna. Med. Bulletin, October, 1909; Amer. Jour. of Anat., vol. x, April, 1910; ANNALS OF SURGERY, September, 1912; Anat. Record, vol. x, January, 1916; Jour. of Morph., vol. xxi, 1911; Amer. Jour. of Anat., vol. xx, July, 1916.

crista galli of the ethmoid bone. The sinuses extend also into the nasal or ascending processes of the maxillæ and into the nasal bones. Numerous finger-like projections of the sinuses have hollowed out the frontal (vertical) portion of the frontal bone (Fig. 1) to an unusual degree.

The total capacity of the three frontal sinuses represented in Fig. 1 is 38 c.c. Everywhere the walls of the sinuses are extremely thin. The enormous capacity of the sinuses in this specimen can better be appreciated when one recalls Brühl's findings. Clinically, it is of importance to appreciate the additional

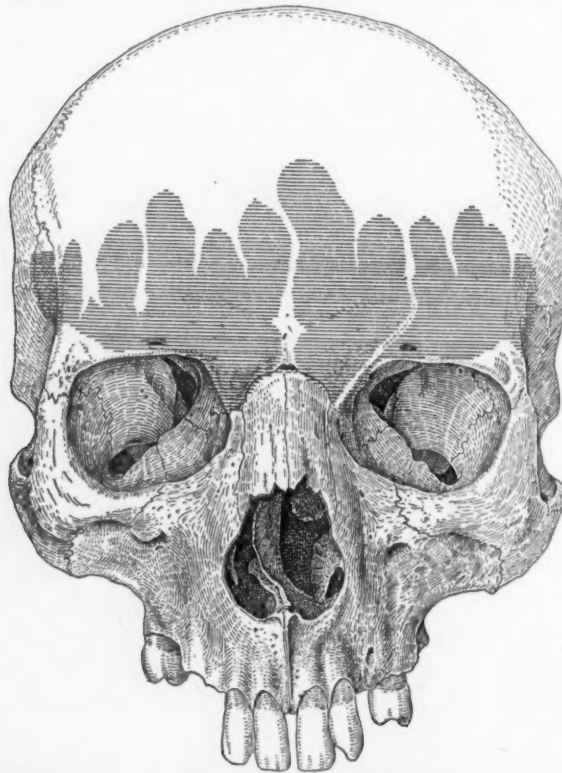


FIG. 1.—Skull from an adult male. The frontal sinuses as present in the vertical portion of the frontal bone and in the great wings of the sphenoid and in the temporal bones are represented by cross-hatching. Note that there are two sinuses on the left side and one on the right. The orbital extension of the sinuses is, of course, not shown. The combined capacity of these unusually large frontal sinuses was thirty-eight cubic centimetres.

anatomic relationships of the frontal sinuses in such extensive pneumatizations.

The second specimen to which I wish to direct attention is also from an adult male. Here the pneumatization of the frontal and adjacent bones is even more extensive than in the first specimen. Every part of the orbital (horizontal) portion of the frontal bone is hollowed out. The intracranial wall of the frontal sinuses is crowded bullous-like towards the anterior cranial fossa. Extensive and numerous finger-like recesses of the sinuses project variously into the vertical portion of the frontal bone (Fig 2). On both sides the sinuses extend into the great or temporal wings (*alæ magnæ*) and into the lesser wings (*alæ parvæ*) of the sphenoid bone. There is even an extension bilaterally into the tem-

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poral bones and well down to the root of the nose into the nasal bones and into the nasal processes of the maxillæ.

The enormous size of the frontal sinuses in this skull is well illustrated in Figs. 2 and 3, showing both frontal and intracranial views. The extensive finger-like projections of the sinuses are well shown in Fig. 2. In Fig. 3 the intracranial wall of the sinus is removed, thus exposing the sinuses in their entirety. It is especially important to note the extensive anatomic relationships of the frontal sinuses in this specimen. The two sinuses are markedly asymmetrical. Many recesses and incomplete bony septa are present. The capacity

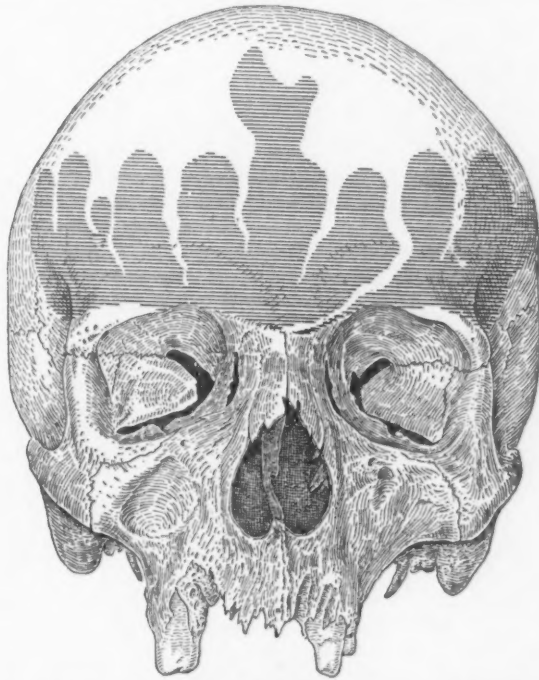


FIG. 2.—From an adult. Two asymmetrical frontal sinuses are present in this skull. The extensive pneumatization of the vertical portion of the frontal bone is represented by cross-hatching. Note the extension into the great wings of the sphenoid, into the temporals, into the nasals and into the nasal processes of the maxillæ.

of the two sinuses (Figs. 2 and 3) is 45 c.c.. In a study of the heads of hundreds of cadavers I encountered many very large frontal sinuses, but such extensive pneumatization of the frontal bone as is found in these two cadavers is unique in my experience.

Agenesis of the frontal sinuses is very unusual according to my studies. Such cases have, however, been reported. Errors have doubtless been made in assuming the sinus absent in those cases in which there was no pneumatization of the frontal or vertical portion of the frontal bone. It is well to recall that the frontal sinus is genetically an

outgrowth from the middle nasal meatus² and that the first evidence of the sinus must not be sought in the vertical portion of the frontal bone. Indeed, in some cases the frontal sinus never does invade the vertical portion of the frontal bone, development taking place wholly in the horizontal or orbital portion.

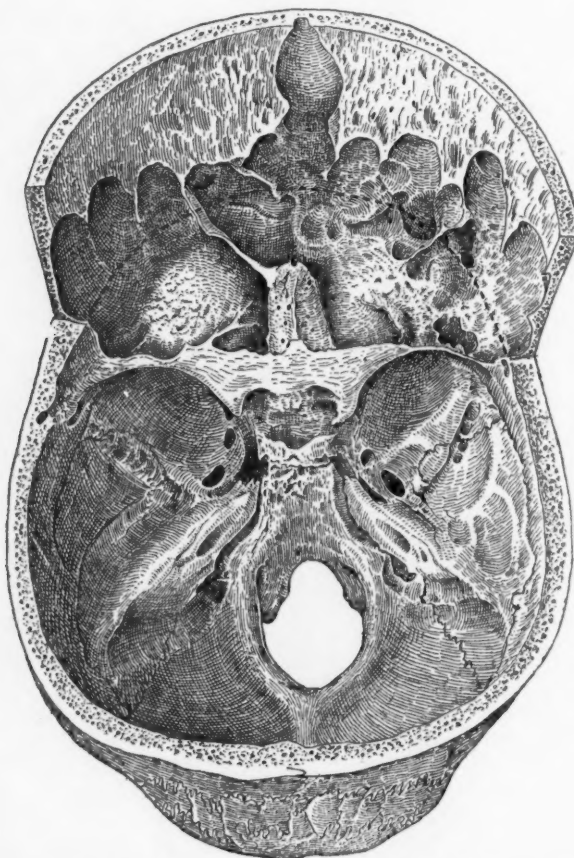


FIG. 3.—Same skull as shown in Fig. 2, illustrating the frontal sinuses by removal of the intracranial wall of the sinuses. Especially note the enormous pneumatization of the frontal and adjacent bones, the many bony septa and recesses and the marked asymmetry of the right and left sinuses. The capacity of the two sinuses in this case (Figs. 2 and 3) was forty-five cubic centimetres. So far as I have reviewed the literature, these are the most extensive frontal sinuses on record.

Witness for example the skull represented in Fig. 5. This specimen was exhibited as a skull with absent frontal sinuses. The vertical saw-cut exposed both frontal lobes of the brain and met at right angles a deep cut made at the level of the nasion (point of contact of the frontal bone with both nasals). Even with this large wedge of bone removed, no frontal sinus was exposed, and in a sense the exhibitor of the skull was justified in declaring the frontal sinuses

²J. Parsons Schaeffer: *The Genesis, Development, and Adult Anatomy of the Nasofrontal Region in Man*. Amer. Jour. of Anat., vol. xx, July, 1916.

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absent. Through the kindness of Doctor Hoffman, the writer was given an opportunity to examine the above skull. The orbital type of frontal sinus was at once suspected. Small trephine openings made at the highest point of the nasal processes of the maxillæ revealed two fairly large frontal sinuses hugging closely the ethmoid labyrinth and extending for some distance into the horizontal portion of the frontal bone over the medial and cephalic wall of the orbit. On the left side a supernumerary sinus was found immediately dorsal to the one ventrally placed. On the right side a supernumerary frontal sinus was found

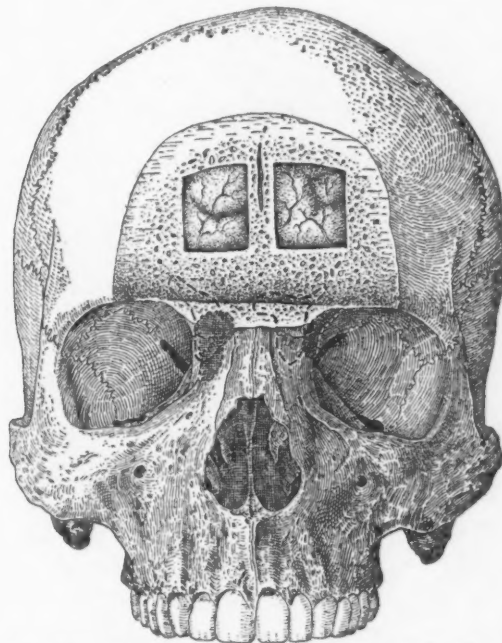


FIG. 5.—From an adult. This specimen was exhibited as a skull with agenesis of the frontal sinuses. Note the large wedge of bone cut out without opening into the frontal sinuses. Openings made at the junction of the frontal bone with the nasal bone and the nasal process of the maxilla revealed the orbital type of sinus hugging closely the ethmoid labyrinth and projecting dorsad and laterad over the orbit and well down to the root of the nose. Two frontal sinuses are present on each side, each with an independent ostium in communication with the frontal recess of the middle nasal meatus. The topography of the two ventral sinuses are indicated by broken lines; the two dorsal sinuses by transverse and vertical hatching. All four sinuses are dorsal to the saw cuts and are wholly orbital in type.

medial to the one first exposed and lateral in position. In the drawing the outlines of the four frontal sinuses are given. They are wholly dorsal to the vertical saw-cut. The ordinary procedure for exposing the frontal sinuses would, of course, have failed to reveal these air chambers in this case.

A common type of duplicate frontal sinus is illustrated on the left side of the adult skull shown in Fig. 4. In this skull the single right sinus has pneumatized both the horizontal and vertical portions of the frontal bone. On the left side the frontal sinus is present in duplicate. The left ventral sinus has invaded both the horizontal and

vertical portions of the frontal bone. Immediately dorsal to the latter sinus is another absolutely independent frontal sinus which has pneumatized the remainder of the horizontal part of the frontal bone as well as portions of the greater and lesser wings of the sphenoid bone. This type of sinus is often overlooked in operative procedures, owing to its depth from the frontal region, its position, and its relations. In order to expose it from the frontal region, the removal of two plates of bone would be necessary.

At times the frontal sinus remains extremely diminutive in size. It is very common to err in these cases and declare agenesia of the

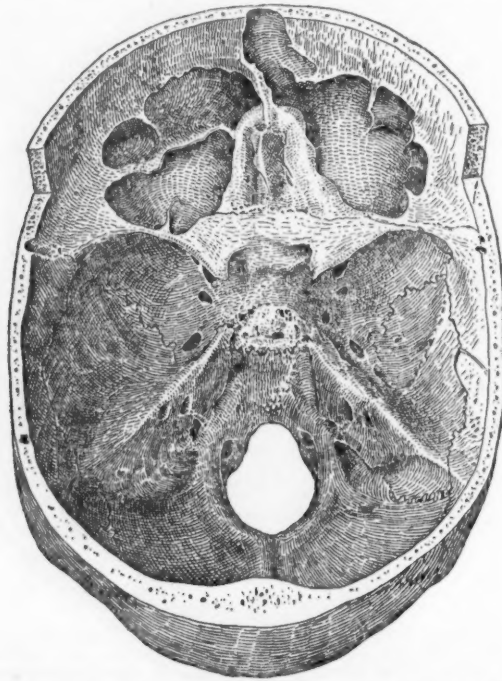


FIG. 4.—From an adult. Skull has three frontal sinuses, one on the right and two on the left side. Especially note the position of the dorsal and orbital sinus of the left side. The latter sinus bears no relation whatever to the vertical or frontal portion of the frontal bone. Two plates of bone separate this sinus from the surface. See text.

frontal sinuses. Only careful search and a realization of the great variations in the anatomy keeps one from "going wrong." Witness for example the dissection illustrated in Fig. 6. Here the frontal sinuses are represented by two small cells located well down toward the root of the nose at the junction of the horizontal and vertical portions of the frontal bone. Their joint capacity is not more than 1 c.c. and they stand in strong contrast to the sinuses represented in Figs. 1, 2 and 3.

In most cases in the first years of childhood and in many instances in the adult the frontal sinus, owing to its location, cannot

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be reached from the forehead. As pointed out before, in most children and in many adults, there is no frontal sinus in the vertical portion of the frontal bone. In these cases the sinus is best exposed in the region where the frontal bone meets the nasal bone and the nasal or frontal process of the maxilla. Indeed, in adults where the frontal sinus exists in duplicate of the type shown in Fig. 4, it may be necessary to open the ventral sinus to get to the one dorsal in position. The skiagram is of great value in determining the presence or absence and extent of the frontal sinus in the region of the forehead, *i.e.*, in the vertical portion of the frontal bone. Where



FIG. 6.—From an adult male. Note the very diminutive frontal sinuses. Compare with Figs 1, 2 and 3.

supernumerary frontal sinuses exist and where the sinuses are of the orbital type, even skiagraphy may furnish erroneous results. Of course, rhinoscopic examination is an invaluable supplement in the diagnosis. Electrical transillumination is unreliable.

The clinician must bear in mind that there is no unvarying typical type of frontal sinus. Great variations are encountered. Agenesis of the frontal sinus is rare; duplication and triplication common. The diseased sinus may be the one dorsal in position and orbital in type. The skiagram may not reveal it. In some cases the frontal sinus is entirely absent in the vertical or frontal portion of the frontal bone, but present and roomy in the orbital or horizontal portion, hugging closely the ethmoid labyrinth and extending far dorsad and laterad into the roof of the orbit.

TOOTH GERM CYSTS OF THE JAW

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THE subject of cystic tumors of the jaw has been considered quite extensively by Bland Sutton,¹ Kaufmann,² Bloodgood,³ Scudder,⁴ and others. The conventional terms applied to these cysts are, in our estimation, inadequate and misleading, since they neither designate the origin nor describe the clinical character of the tumor.

We shall, therefore, divide the cystic tumors of the jaw into, (A) inflammatory cysts, (B) tooth germ or chorioblastomatous* cysts. The cysts of class A, generally called dental and root cysts, will not be considered in this paper because they do not originate in the embryonal epithelial remnants of the enamel organ as claimed by Magitot.⁶ We fully agree with Partch⁷ that these cysts are of inflammatory nature. Whether or not the wall of the cysts is lined by epithelium, as described by Turner,⁸ is immaterial. Suffice it to state, they invariably originate in a periodontitis, as a result of which a granuloma forms. With softening and breaking down in the centre of the granuloma, a cyst follows. Should there by chance be present remnants of the epithelial cord of the enamel organ, they will become included in the granuloma, and this undoubtedly accounts for the epithelial lining of some of these cysts, the prime cause of which is, however, an inflammatory process.

The true tooth-germ cystic tumors that we have put into class B are divided into the (a) unilocular cyst, commonly known as the dentigerous or follicular cyst; and (b) multilocular cyst, conventionally designated as adamantine epithelioma, multilocular dentigerous cyst; and (c) the solid tumor.

These cysts of the jaw are rather of infrequent occurrence. We have been able to collect for our study six cases of this type; three cases from the surgical material of Dr. A. P. Condon, Nicholas Senn Hospital, and three cases from the material of Dr. Frank J. Hall of

* By the term Chorioblastoma, Albrecht⁵ designates all tumors that are derived from embryonal rests.

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Kansas City, Missouri. (I wish to express my thanks to these men, not only for access to their material, but also for much kindly advice and criticism.)

These cases form the basis of the present writing.

The embryonal cysts have a positive relationship to that part of the epithelial cord that does not enter into formation of the enamel organ, the "*débris épithéliaux paradentaires*" of Malassez.⁹ This view, originally proposed by Falkson¹⁰ and later confirmed by Malassez,¹¹ Kruse,¹² and others, is undoubtedly the correct one. However, there are some who deny the embryonal origin of these tumors. Bland Sutton¹³ and his school believe that the multilocular cysts originate from the oral mucous membrane, for were they derived from embryonic enamel organ, they would have occurred at an earlier period. This argument against the embryonal theory of the cysts, we believe, is not well founded, for other tumors that arise from aberrant embryonal tissue, *e.g.*, hypernephroma, occur in persons past middle life and not necessarily in youth. Again the histopathology of the tumor speaks against the above assumption, as it will be described below in one of our cases that there was a distinct formation of dentin, which property can hardly be ascribed to the oral mucous membrane (Fig. 8). That these tumors are not endotheliomas will be pointed out in the differential diagnosis. That both the unilocular and multilocular cysts originate from one and the same source is evident from their concomitant occurrence; and, as it will be mentioned in one of our cases, one half of the cyst presented the picture of a unilocular cyst while the other half that of a multilocular (Fig. 5).

Our case of simple unilocular cyst had a distinct adamantine epithelial lining which strengthens this assumption (Fig. 2). Barrie¹⁴ has described a similar case of unilocular cyst with an adamantine lining. Why in one instance aberrant epithelium will form teeth and a unilocular cyst, and in another a multilocular with more solid parts, is difficult to explain. One finds a similar condition in the ovarian cystoma; where, in one case, there is a simple, smooth-walled cyst, and in another, or, very frequently, in parts of the same cyst, a marked proliferation of epithelial lining, with the formation of well-sized solid masses, which may completely fill out the greater part of the cyst.

The recent anatomical work of Cryer¹⁵ upon the mandible as a possible explanation for the multilocular character of these cysts will be touched upon later.

The course of development of the unilocular cyst is well illustrated by the following case:

CASE I.—Mrs. T. S., aged twenty-three, was operated upon at the Nicholas Senn Hospital, February 18, 1913. She had a swelling that she had noticed for six months in the left lower jaw, back of the second molar tooth, and a constant dull pain for the past few weeks.

An incision was made over the swelling from within the mouth and the bony wall of the cyst was chiseled away, a tooth removed from the depth of the cyst, and a lining membrane, about 2 to 4 mm. in thickness, was peeled out of the cystic cavity. She left the hospital well on March 1st. No recurrence was reported (Fig. 1).

Pathological Report.—Size of the cyst is twice that of a large olive; cyst contains a thick, colloid-like material, blood-tinged. The walls of the cyst are thickened, and at the bottom there is lying free in the cavity a molar tooth, which appears to be well developed.

Microscopical Report.—The wall of the cyst consists of connective tissue stroma containing many blood-vessels. The inner surface of the wall is lined by a layer of epithelium of adamantine type. The basal cells have a spindle nucleus; the cells nearer the superficial surface show the stellate adamantine form which conveys the impression of mucoid tissue (Fig. 2).

The unilocular cysts may occur at any age. Brophy¹⁶ has seen only 12 cases of such cysts associated with deciduous teeth. They are found more frequently, however, during, or after, second dentition; rarely after 30 years. The usual seat of their location is the region of wisdom or bicuspid teeth, which fail to erupt. Both jaws are affected with equal frequency. The tumor is benign in character and runs a long course. The prognosis in these cases is good, as no recurrence follows after a complete excision of the cyst.

The multilocular chorioblastomatous cyst of the jaw is of less frequent occurrence than the unilocular. Lewis¹⁷ has collected 70 cases from the literature. Since then, New¹⁸ has added 8 more cases. With the report of 4 of our cases of this type, the total would be 82 cases. By far the most common seat of involvement is the molar region of the lower jaw. Only in 9 instances have they occurred in the upper jaw (New). In our series the seat of involvement in one instance was the upper jaw and three occurred in the lower jaw. Although Massin¹⁹ has described the occurrence of such a tumor in a new-born infant, and Coots²⁰ observed one in a child 5 months old, yet the age at which they commonly occur is between 20 and 40 years. The oldest case on record was 75 years old (Lewis).



FIG. 1.—Case I. X-ray of unilocular cyst of jaw. Tooth seen in the cavity of the cyst.

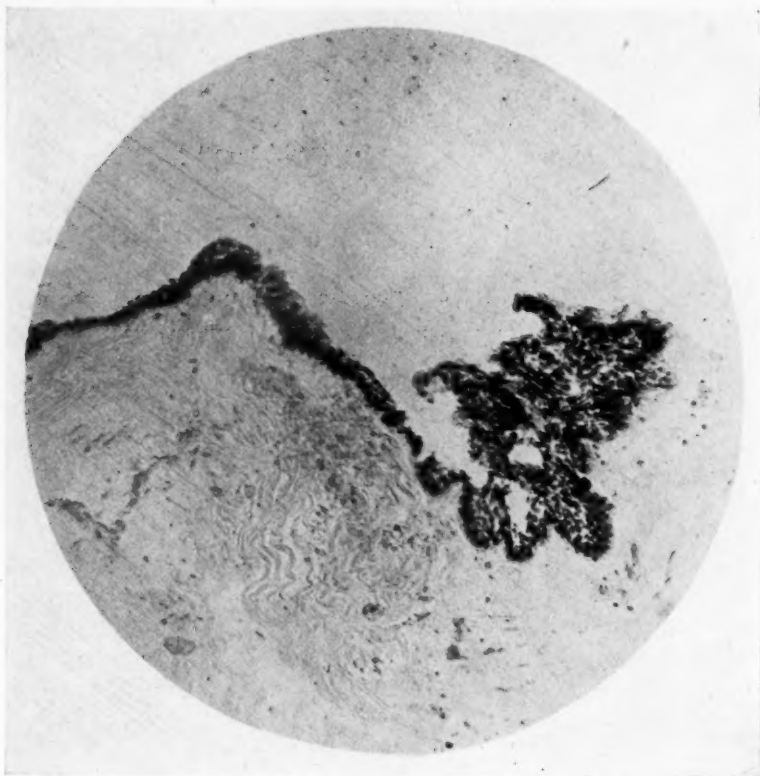


FIG. 2.—Case I. Photomicrograph showing the adamantine lining of a unilocular cyst.



FIG. 3.—Case II. Multilocular chorioblastomatous cyst of jaw before operation.



FIG. 4.—Same as Fig. 3, after operation.

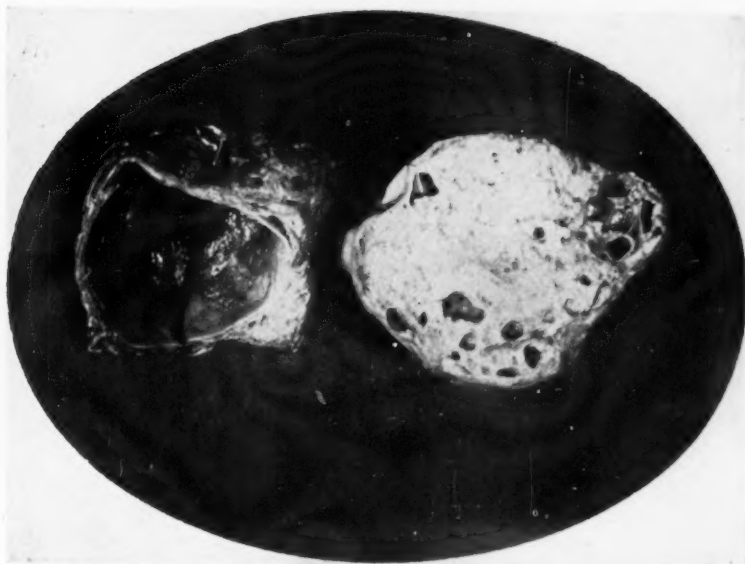


FIG. 5.—Case II. Multilocular and unilocular cyst of jaw (gross specimen).

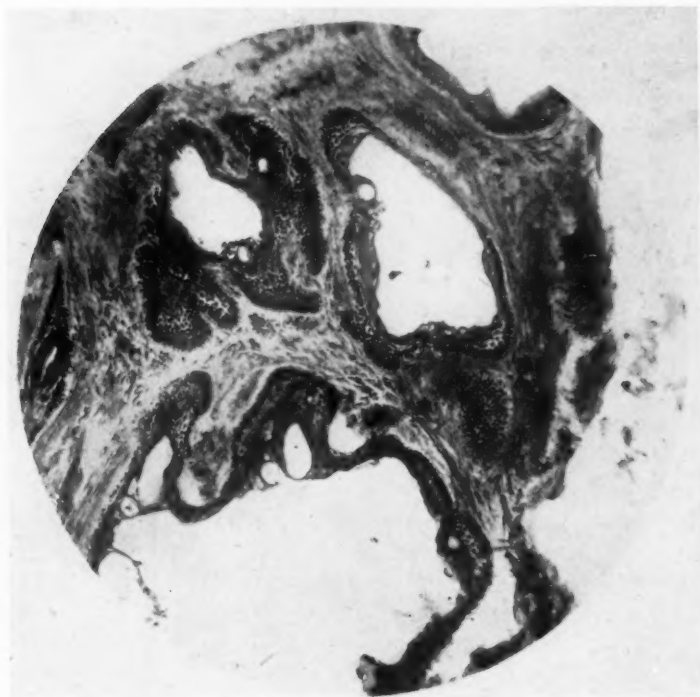


FIG. 6.—Case II. Photomicrograph showing epithelial villi and cysts.

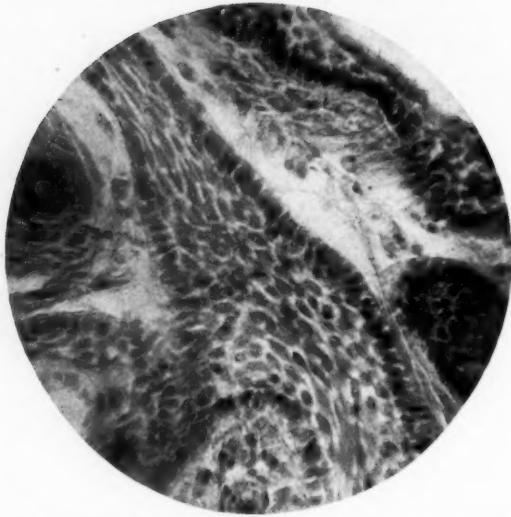


FIG. 7.—Case II. Photomicrograph showing part of a villus. Note the cylindrical cells in the outer layer and the stellate shaped cells in the centre.



FIG. 8.—Case III. Photomicrograph showing dentine formation *A* and *B*.

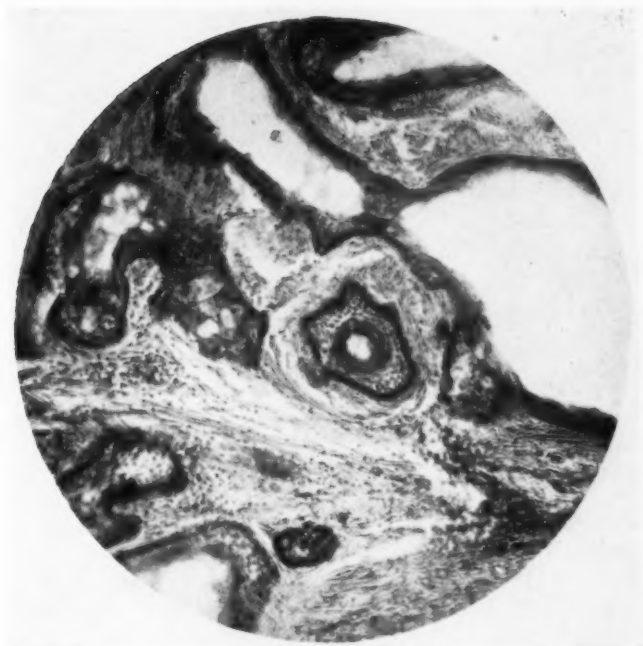


FIG. 9.—Case V. Photomicrograph showing the formation of epithelial cords surrounded by cement.

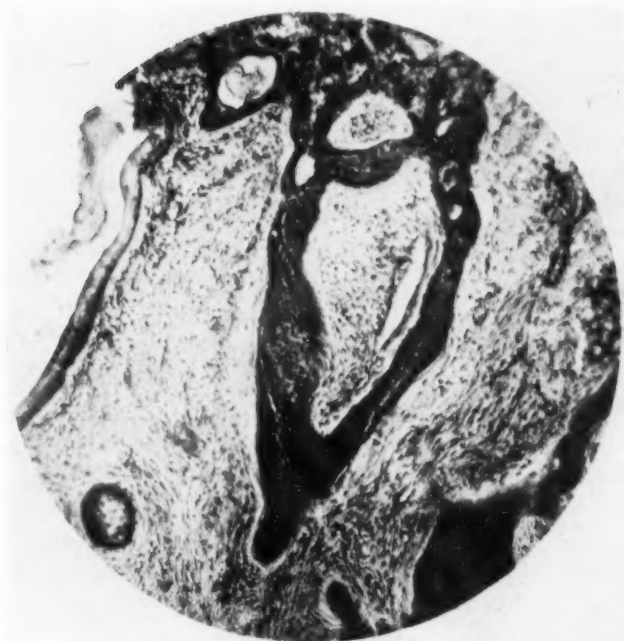
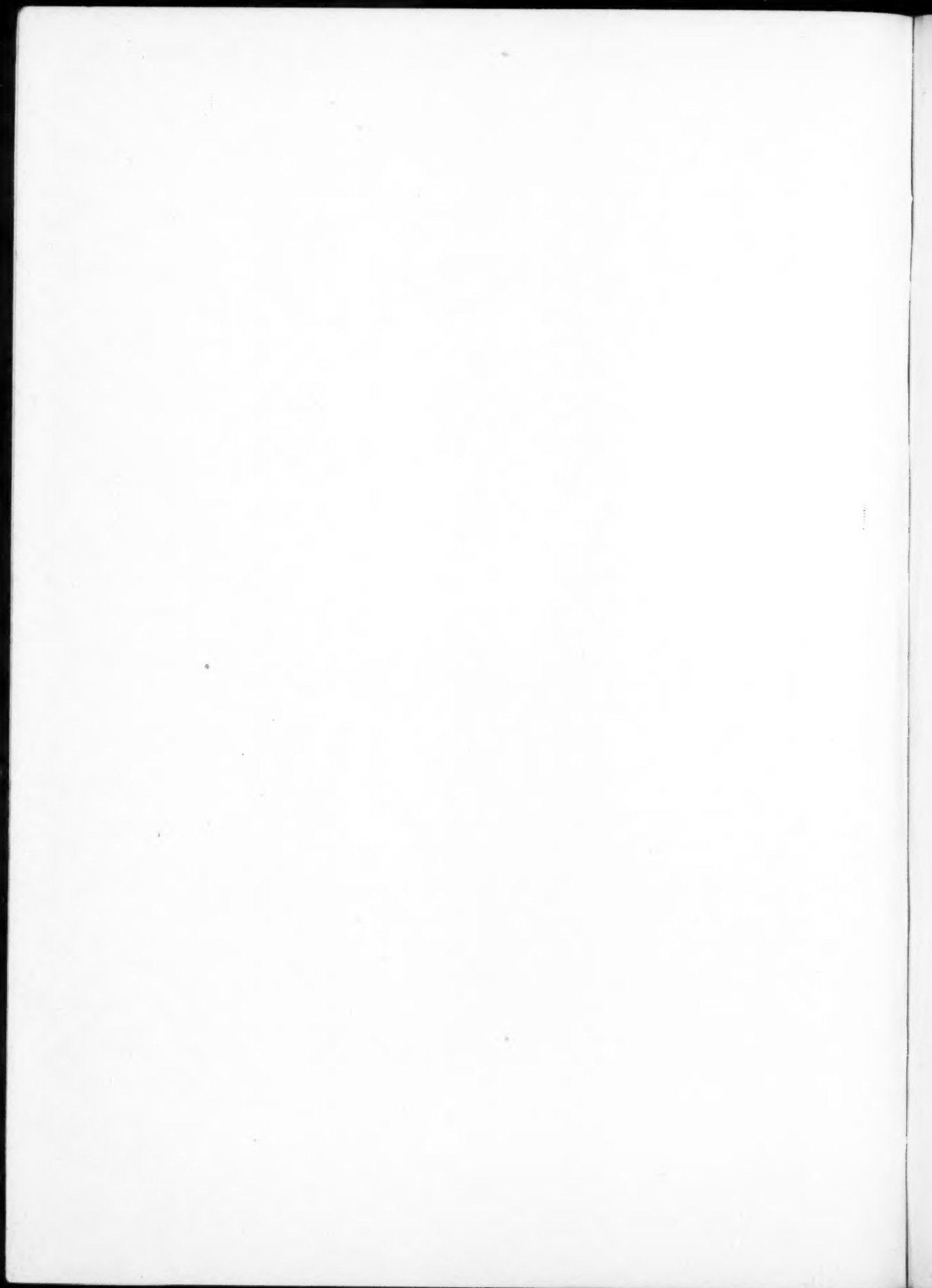


FIG. 10.—Case VI. Photomicrograph of section of solid tooth-germ tumor in upper lip.



TOOTH GERM CYSTS OF THE JAW

The growth of the tumor is very slow, as illustrated in the following cases.

CASE II.—Miss A. C. entered the Nicholas Senn Hospital on Tuesday, July 22, 1913, with the following history: Age 42 years, unmarried. Twenty-four years ago a swelling began in the lower jaw on the left side in the molar region. About nine years ago it was about half the size it is now and was operated upon by another surgeon. The patient says the surgeon told her it was a sarcoma and could not be removed. Following this operation a sinus kept discharging and a year later was operated upon by a different surgeon and piece of the wall of the tumor taken out, she says. The tumor remained about the same until three years ago and it began to grow rapidly.

Upon examination the tumor presented a solid growth, extending to the hyoid bone and well up into the temporomaxillary articulation. The whole mass had a bony feel, excepting the part near the lobe of the ear, which had a tense cystic feel. The mass extended a finger's breadth above the lobe of the ear. There was no ulcerated area.

The patient was operated upon July 26th. The jaw was cut through at the symphysis and disarticulated at the temporomaxillary joint. She left the hospital August 16th and has since remained well (Figs. 3 and 4).

Pathological.—The tumor is size of man's fist enclosed within a thin bony wall of the lower jaw. Tumor has a honey-comb appearance. The small cysts are filled with a gelatine-like fluid. The solid parts of the tumor are of rather soft consistency and of grey-white color. One-half of the tumor presents a single cyst, size of a small hen's egg, having smooth walls and is filled with thick gummy substance. There being no direct communication between it and the multilocular part of the tumor (Fig. 5).

Microscopical.—Sections taken from solid parts of tumor show a connective tissue stroma which is poor in blood-vessels. In the stroma there are found epithelial villi which form interlacing twigs having the picture of an epithelioma. The villi are made up of an outer layer of cells which are cylindrical and placed perpendicular to the stroma. Centrally from this layer there are cells of cubic shape and some are flat. In the centre of some of these villi there are interlacing stellate shaped cells. In other parts of the tumor there are macroscopic and microscopic cysts of varying size. The cysts are lined by similar cylindrical and flattened cells. Inside the cyst there is contained granular degenerated material (Figs. 6 and 7).

As Steensland²¹ has suggested in the study of his cases that the cylindric cells correspond probably to inner epithelial layer of enamel organ and the cubic cells to the outer epithelial layer. The flattened

cells are likely the precursor of the stellate cells of the stratum intermedium. Section taken through wall of outer half of tumor of Case II shows a dense connective-tissue wall, within which are found solid masses of epithelial cells. The inside of the cyst is lined by epithelial cells of adamantine type.

CASE III.—Miss A., 20 years old; tumor noticed for the last 4 years. Tumor located in the upper jaw of right side at the first molar region. No teeth erupted through the gum over the tumor. The tumor was slow and painless. Opposite side presented an accessory molar tooth erupting behind the normal teeth. Tumor excised and no recurrence reported.

CASES IV and V.—The tumor occurred in the lower jaw. Duration of growth was several years. One of these cases occurred in a female and the other in a male, aged twenty-eight. We regret that a more definite clinical history could not be obtained since we lost track of these cases.

The Cases III and IV present a pathologic picture similar to Case II, except that in Case III there is marked formation of dentin (Fig. 8).

Case V differs from the rest. The epithelial structure of the tumor is continuous with the epithelium of the gum. This tumor might be mistaken for a true malignant epithelioma. However, the tendency of the epithelial cords to be surrounded by true cement formation and the appearance of cells obviously attempting to form stellate adamantine, stamp the character of the tumor (Fig. 9).

The pathogenesis of this type of tumor has been dwelt upon above. Its multilocular character can be probably explained by Cryer's work²² who demonstrated the "inferior dental canal to be a cribriform structure; that an abundant communication exists between the vacuoles or loculi of the cancellated tissue of the bone; that the alveoli of the teeth are not only in communication with the inferior dental canal but with the loculi of the cancellated tissue in all directions and with one another through the same channels."

We are inclined to accept this as a plausible explanation of the nature of the above tumor. Since one can readily understand that a large single cyst, in which the epithelial lining is undergoing a marked proliferation with formation of solid masses, may become multilocular by the growth following the communicating canals. If this view be correct one can explain the recurrence of these tumors after incomplete excision.

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Multilocular embryonal cysts are benign in character although as we mentioned they may recur if excision is incomplete. In our cases no recurrence is reported, the oldest being 6 years after operation.

Solid tumors, arising from rests of the adamantine epithelium, are of great rarity. In the case to be described below a tumor of this kind occurred in the upper lip.

CASE VI.—Young man, age 25. Had a small cherry-sized tumor in upper lip. Tumor was easily shelled out.

Pathological.—Size of tumor, that of a cherry—encapsulated. Hard consistency.

Microscopical.—Same picture as described under Case II except that the solid masses were in greater preponderance than in Case II.

After careful search of the literature I was unable to find a single instance of adamantine tumor occupying the position above indicated.

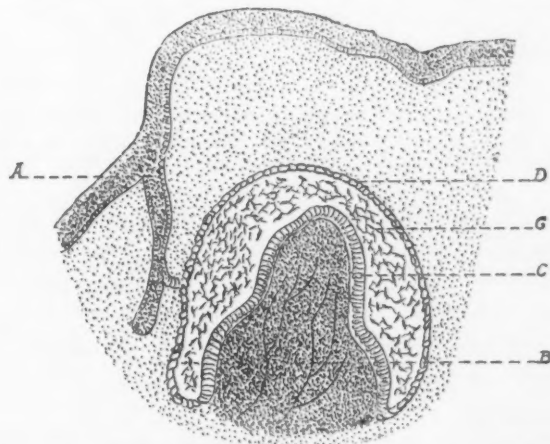


FIG. 11.—Schematic representation of the embryology of a tooth (after Kaufmann). A, epithelial cord; B, tooth papilla; C, inner layer, cylindrical cells; D, outer layer, cubical and flat cells; G, stellate reticulum.

Cases of unilocular embryonal cyst were reported to occur in the gums and orbital region. The unusual position of the tumor can be explained by the embryology of the teeth (Fig. 11).

The epithelium over rudimentary alveolar process dips down into mesodermic connective tissue and constitutes the epithelial cord, A. From the epithelial cord the future enamel organ is formed. The enamel organ becomes invaginated by the underlying mesoblastic tissue and this forms the tooth papilla from which dentin, cement, and tooth pulp are produced, B. The bell-like enamel organ possesses three

kinds of cells; the inner cells, tall and cylindric, *C*; outer layer cells, which are flat and cubical, *D*; the layer between the two consists of stellate reticulum, *G*, stellar cells which anastomose with each other and form mucoid tissue.

Only the upper part of the inner layer of cells which invests the tooth crown is capable of producing enamel. The cells at the lower part of the enamel organ lose property to produce enamel and grow deeper into mesoderm, forming a covering for the root of the tooth. By and by, this epithelial covering becomes absorbed and replaced by mesodermic cells. However, epithelial rests remain in the embryonic jaw. Malassez found such rests in most of the cases studied by him. One can readily see how epithelial tissue may become dislodged into the under surface of oral mucous membrane, and, when aroused to activity, proliferate, forming a solid tumor, as was the case with our patient, Case VI. Or, when the tissue is displaced into the body of jaw, cysts form which may be unilocular or multilocular, depending upon the proliferation of the lining of the cyst. Of course, some other factor is necessary to explain why, after having been dormant for years, bits of aberrant adamantine epithelium take on active growth.

Probably, as Senn has suggested, trauma or inflammation plays a rôle by increasing the blood supply, which stimulates the cells to active proliferation.

Differential Diagnosis.—The points of diagnostic importance are: the clinical history of the case. The extremely slow and symptomless growth differentiates these tumors from sarcoma, endothelioma and myeloid tumor. The second point in the history is absence of teeth over area involved. Third point is the absence of infiltration and no fixation to the bone of jaw. The X-ray is of some diagnostic value as illustrated in Fig. 1.

Microscopical sections show cells of the adult type corresponding to the cells forming enamel and dentin; arrangement is in long strings and gland-like structures, the latter sometimes presenting dentin formation in the lumina of the gland-like masses. Intact basement membrane always found sharply demarked by cell masses and gland-like structure from surrounding connective tissue. The occurrence somewhere in these masses of the characteristic stellate cells. The great variation of cells found in adamantine tumors will differentiate them from endothelioma, in which the cells are a uniform shape and type.

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CONCLUSIONS

1.—The conventional terms employed for cystic tumors of the jaw are neither descriptive nor accurate.

2.—Cystic tumors of the jaw are divided into (A), inflammatory; (B), tooth germ (chorioblastoma)—(a), unilocular; (b), multilocular; (c), solid.

3.—Chorioblastomatous cysts of the jaw originate from the embryonal rests of epithelial cord of enamel organ.

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- ¹⁷ Lewis: Surg., Gyn. and Obst., 1910, x, pp. 28-36.
- ¹⁸ New: Jour. Amer. Med. Assoc., 1915, xiv, pp. 34-39.
- ¹⁹ Massin: Virch. Arch., 1894, cxxxvi, p. 328.
- ²⁰ Coots: Brophy, Oral Surg., p. 859.
- ²¹ Steensland: Journal Experim. Med., 1904.
- ²² Cryer: loc. cit.

TWO CASES OF THORACIC ANEURISM WIRED FOUR YEARS AND THEREABOUTS AGO RESPECTIVELY*

WITH REMARKS ON THE ANTISPESIFIC TREATMENT AND THE OPERATIVE TREATMENT
OF THORACIC ANEURISM

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THE following two cases of thoracic aneurism were presented before the New York Surgical Society two years and a half ago (ANNALS OF SURGERY, lix, 1914, p. 461, Cases II and III). Both cases after the wiring operation were given antispecific treatment, and they developed an ability to endure very severe exertion. Special attention is called to the need for treatment of aneurism with the antispecific remedies, which the writer believes should be administered in the way herein described in order to get good results.

CASE I.—V. A., bar-tender, present age forty-two. Referred by Dr. A. de Yoanna. The Moore-Corradi operation of wiring with electrolysis was performed on May 3, 1912. The patient had had pain for about one year prior to operation, which, from a time three months before operation for a period of one month, had been so great that he could not sleep. Just before the operation there was a steady pain in the right axilla and in the inner side of the right arm. The aneurism had eroded through the right second costal cartilage. Pulsation was not very forcible. No bruit. No respiratory symptoms. For a month prior to coming to the hospital he had been given mixed treatment with no apparent benefit.

At operation seventeen feet of the "clasp" gold wire No. 29, shaped in evenly curved loops from $4\frac{1}{2}$ to $5\frac{1}{2}$ inches in diameter, were introduced into the aneurismal cavity through an insulated gold needle. The electric current used was 100 ma. for seventeen minutes and 50 ma., 40 ma., and 30 ma., each for fifteen minutes. After thirty-five minutes of the electrical séance the pain had entirely subsided. During convalescence the pains were intermittent and of short duration. In the course of a month following the operation there was practically no pain unless from too much exertion. At the end of two months the patient could walk three or four short blocks without pain. He worked all that

* Cases presented before the New York Surgical Society, May 10, 1916.

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summer tending bar, having very little pain and that only occasionally. Antiluetic treatment was at first withheld in order to test the efficacy of the wiring operation of itself to relieve the pain. He began taking mixed treatment the end of May, 1912, and took the same pretty regularly until the following March. He thought when the mixed treatment was interrupted that he would have more pain, which would seem to leave again on his return to the medicine. With excessive exertion he would have a temporary return of pain. On February 26, 1913, it is recorded that he was daily walking up one flight of stairs four or five times, was on his feet seven or eight hours, was walking four to five blocks and suffering no pain. This was before he was given salvarsan. Between March 31 and November 28, 1913, he was given four injections of neosalvarsan, two of 0.3 g. and two of 0.45 g., two injections of salvarsan 0.3 g. and eleven intramuscular injections of the salicylate of mercury, in the course of which treatment his activity was greatly increased. On September 11, 1913, it is recorded that each day he would stand all day working as bar-tender, would lift 30 to 40 pounds about once and would walk about two miles. About twice a week he would have a little pain following exertion lasting about five minutes. On November 18 of the same year, he stated that a quick walk for half a mile had excited a little pain. In the winter of 1913-1914 he and his brother, who also had a thoracic aneurism which was wired by the writer, went to Brazil, where for seven months they both peddled suits of clothes, carrying the same in packs on their backs, walking about six miles every day, stopping from house to house, being thus engaged about six to seven hours a day, each carrying a pack weighing at the beginning of the day about 50 pounds. Neither of them had any pain during this time. They were some of the time at Rio Janeiro, which is a hilly city. In the fall of 1914, while in Italy, two or three times this patient walked six or seven miles on the level without pain or any difficulty. In the past fifteen months (prior to May 10, 1916) he has been the proprietor of a restaurant in a neighboring city, and has done no particularly hard labor. He walks habitually twelve blocks a day and on Sundays he walks about two miles slowly. In the past fifteen months he has had no pain in the right side of his chest, except three months ago he had an attack of pain in this locality as well as in the right upper extremity lasting about two minutes accompanied by dizziness and pallor, and two weeks ago he had a second similar attack lasting three or four minutes. During the past winter every day he carried up two pails of coal from the cellar, two flights, one pail in either hand, each weighing about 25 pounds. There was no ill effect from this work. In the winter of 1913-1914 he took a

bottle and a half of mixed treatment and in the spring of 1915 three bottles more. He has had no treatment since. His Wassermann, at first negative, in April, 1913, was found to have become positive and in September, 1913, was very strongly positive. In over two years the patient has been seen only twice by the writer.

CASE II.—G. S., machinist, present age fifty-two years. Referred by Dr. Leon T. LeWald. In March, 1910, he began to have pains in his chest. In April, 1911, he noticed a lump in his chest and the pain became continuous day and night in the front and back of the left side of his chest and in his left arm. The pain was very severe so that he could hardly sleep and he groaned with the pain. In June, 1911, he went to a hospital where as a result of resting and the taking of potassium iodide for four weeks, he improved so much that he was able to return to work on a radial drill, at which employment he then continued until July 3, 1912. During this time he had pain only when he worked, but not at night until about the middle of June, 1912, when the pain came on at night as well, but was not so severe as it had been the previous year. In fact, at that time he was able to sleep four or five hours at night. He had no shortness of breath. He had to scrape his throat a little. The aneurism could be readily felt pulsating in the left second and third intercostal spaces as far as to three inches from the median line and faintly in the first space. In the second space the aneurism was very tender. On July 8, 1912, he walked about three miles.

Operation (July 20, 1912).—About 22½ feet of No. 29 "clasp" wire, shaped in evenly curved loops 6 to 7½ inches in diameter, were introduced. The current used was 100 ma., 50 ma., 40 ma., and 30 ma., each for fifteen minutes. Just before the operation the patient, when resting, had had but little pain, so that no marked immediate effect from the operation was noted. The second night following the operation the patient was conscious of a marked diminution in the pulsation and he began lying on his right side which previously he had been unable to do. After five weeks in bed he soon was climbing three flights of stairs (not by advice) without trouble, and on September 20 he easily lifted one end of a 150 pound weight.

The interesting feature of this case is the considerable amount of labor that he has been able to perform. Excessive exertion has frequently brought on temporary pain which has always gone away with stopping the physical effort. The attacks of exacerbation of coughing with considerable expectoration have usually come on following exposure to wet. There has never been pressure on the trachea causing any obstruction to the breathing.

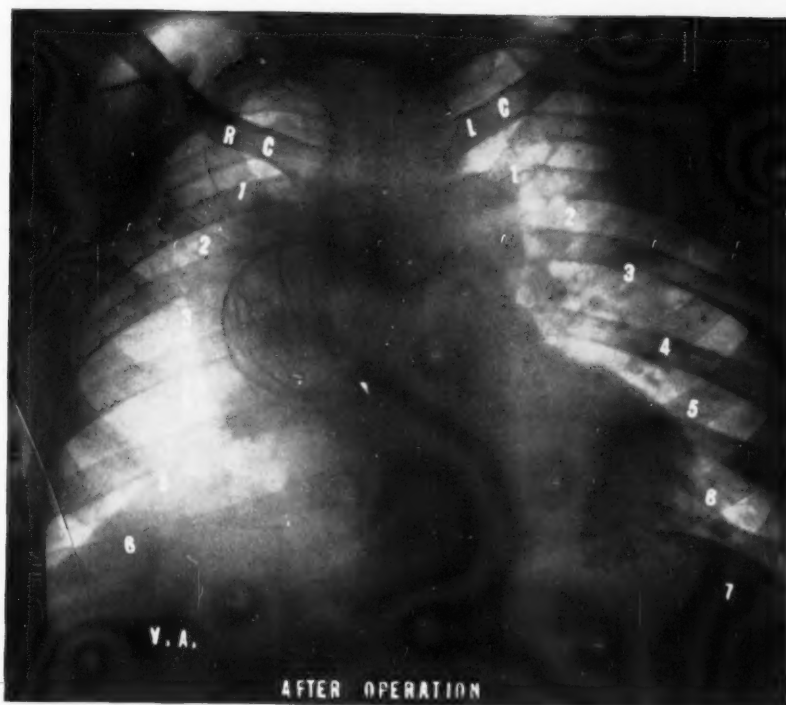


FIG. 1.—Patient V. A., after the wiring operation. (Taken by Dr. Byron C. Darling.)

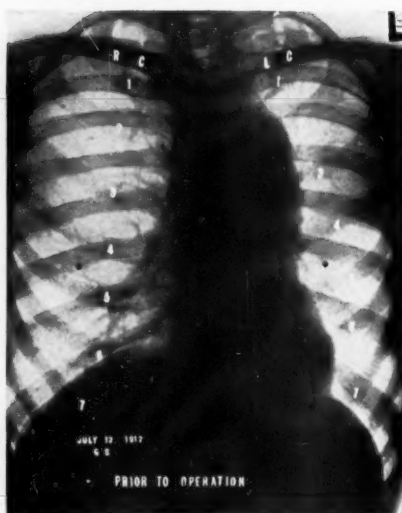


FIG. 2.—Patient G. S., X-ray of July 12, 1912, before operation, Direct anteroposterior view. (Taken by Dr. Leon T. LeWald.)



FIG. 3.—Patient G. S., after the wiring operation. Exposure slightly oblique so that the shadow is thrown a little more to the left than it would have been in a direct anteroposterior view. (Taken by Dr. Byron C. Darling.)

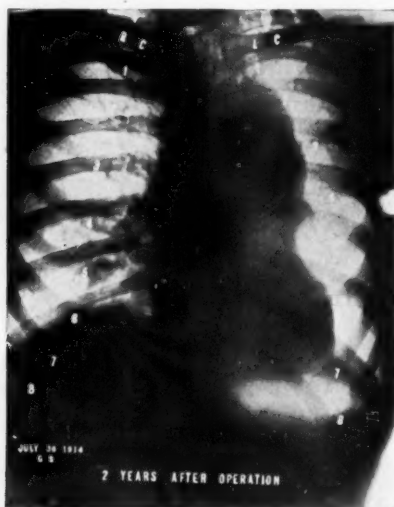


FIG. 4.—Patient G. S., July 30, 1914. Direct anteroposterior view. Compared with Fig. 2, it shows about $\frac{1}{2}$ an inch increase in transverse diameter of the aneurismal shadow since before the operation. (Taken by Dr. Leon T. LeWald.)

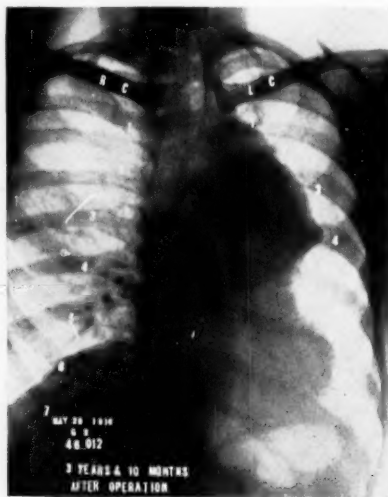


FIG. 5.—Patient G. S., May 28, 1916. Exposure slightly oblique, so that the aneurismal shadow is pitched a little too far to the left for a comparison of its size with that of the shadows in the direct anteroposterior views. Small area of bulging to the left. (Taken by Dr. Leon T. LeWald.)

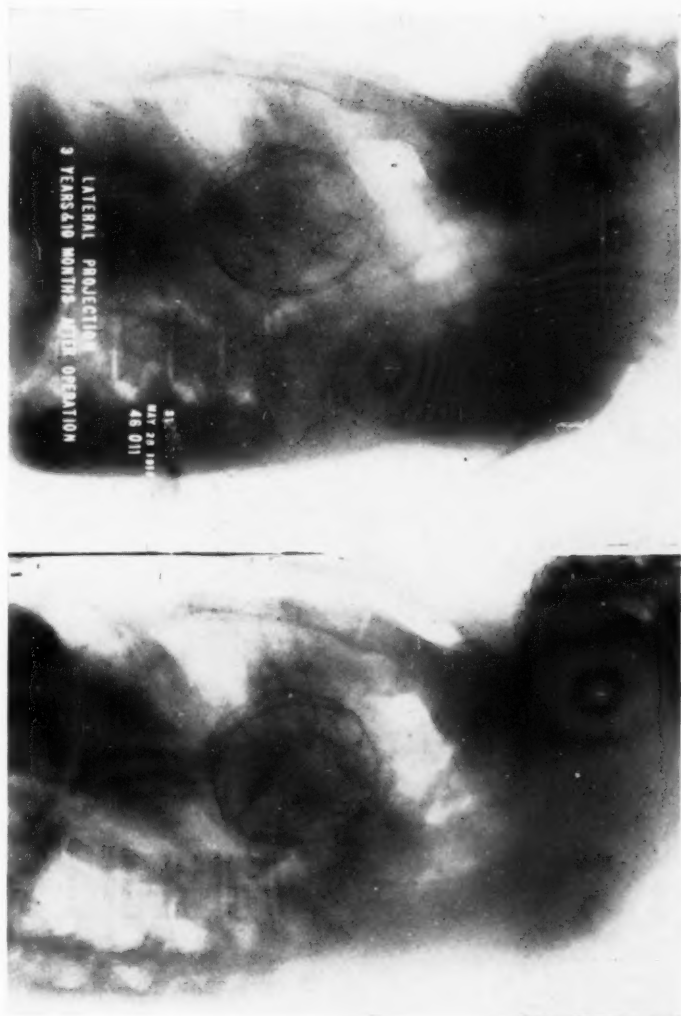
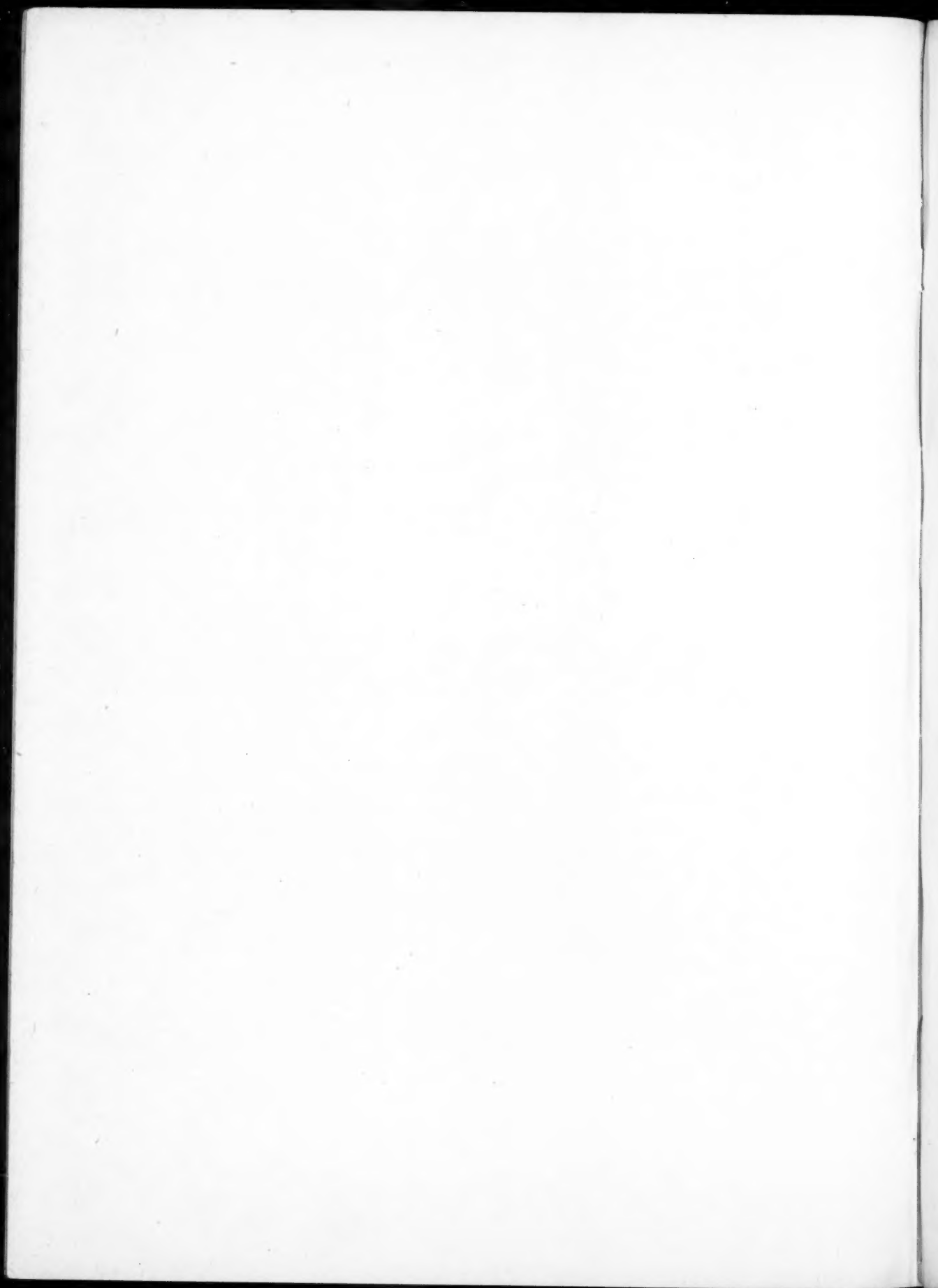


Fig. 6.—Patient G. S., May 28, 1916. Stereoscopic X-ray of the wire, viewed from the side. Size for hand stereoscope
(Taken by Dr. Leon I. LeWald.)



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That this patient has been able to put forth such exceeding physical effort would seem to indicate that the wiring operation and the arrest of the aortic disease by the medication had together strongly fortified the aneurism wall. The patient has frequently mentioned that the taking of coffee has seemed to give him pain. Also he has sometimes attributed the pain to gas in his stomach. Pain in his chest following the taking of food is relieved by belching gas. Figs. 2, 3, 4 and 5 show X-rays of this aneurism at different periods of time.

Antispecific treatment was withheld until September 30, 1912, when mixed treatment was begun and taken for six weeks out of every eight up to March 15, 1913. Between January 10 and February 16, 1913, he was given 3 doses of neosalvarsan 0.3, 0.45, 0.6 g., following which his activities became very much increased. He seemed to experience the most decided improvement, however, the middle of March on stopping the mixed treatment, when he observed that he felt stronger and that practically all pain left. Two weeks later on beginning mixed treatment again, pain returned, but on stopping this medicine it again went away. The writer has noticed an apparent intolerance for potassium iodide for a time after one of the salvarsan preparations has been given. Wassermann on February 16, 1913, had become negative and was still so on the following May 12.

The patient returned to work, taking up his former job on the drill press, the end of October, 1912, up to which time he had been having a little pain lasting a few minutes four or five times a day. He kept at this employment for a week, having pain most of the time while at work. For three or four weeks in November and December the effort of lifting gates at a railroad crossing by means of a crank, at first caused only a little pain, but with stiffening of the machinery he was obliged to relinquish the job. Two days after stopping this work the pain entirely left. Prior to receiving neosalvarsan he would have a little pain if he walked as much as half a mile in fifteen minutes. On February 6, 1913, eleven days after his second dose of neosalvarsan, he walked about eleven miles without a symptom. On the night of February 11, 1913, he cranked the railroad gates, which was pretty heavy work, having no pain until the following afternoon. Early in the following March he worked in a machine shop where he had to lift about 20 pounds about every quarter of an hour for nine hours a day. Thus employed, for two days he had no pain, but on the third and fourth days pain ensued and he had to stop. On May 3, 1913, the record states that he was not working, but was daily climbing six flights of stairs to his room and walking five or six miles and had no pain or cough. On May 14 he worked eight and a half hours, carrying refuse cans weighing

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about 100 pounds a distance of about 100 feet and loading them on a truck, and throwing bags weighing about 70 to 100 pounds down a chute. He had no pain but experienced heavy throbbing. On June 13 he spat up about ten mouthfuls of bright red fluid blood. The hemorrhage subsided. In the summer of 1913 he had pain only on occasion from excessive effort. Thus in August he was employed where he used an 18-pound sledge hammer at intervals, and was obliged to lift about 100 pounds. He worked at this job five days and left because he had a little pain which lasted only about one day. A job at heavy filing ten hours a day caused a little pain while at work. September 2, he got a job in a machine shop running a big radial drill where he had to lift 30 to 50 pounds several times per day. He had had no pain after eight days of this work. With a view of reducing his physical effort, he was then sent, with the cooperation of Dr. Warren Coleman, to the Sharon Industrial Home for Cardiacs, but he soon went back again to work on a drill press, where this time, however, the work was lighter, he usually not having to lift more than five or six pounds.

In the fall of 1913 his Wassermann having become positive again, further antispecific treatment was administered. Between November 30, 1913, and March 29, 1914, he was given 14 intramuscular injections of mercury, and on January 18, 1914, neosalvarsan 0.45 g. From March 16 to August 10, 1914, excepting for three weeks, he was given potassium iodide grs. v to vii or mixed treatment t. i. d. For three weeks in September and October he returned to the potassium iodide but he finally complained of its giving him pain in the stomach so that it was stopped.

Between November 18, 1913, and February 7, 1914, he worked off and on doing the lighter work on the drill press, having but very little pain and that only while at work. He would go for intervals of several days at a time without any pain at all. There was no immediate improvement noticeable following the neosalvarsan on January 18, 1914. On January 24, 1914, he had no cough or expectoration. His cheeks were rosy and his general health excellent. On February 19 he got wet and caught cold and had cough with expectoration until the end of March, the cough continuing into May. From February 7 to August 15 of this year he did but little work. In June he worked seven days on a drill press, lifting weights up to 75 pounds without having any pain. Notes of July 18, 1914: Has had no pain in about six weeks, he last having had a little after a ten-mile walk. Has had no cough since early in May. Whenever he is out of work he walks from six to eight miles a day. His health is excellent. These notes were made at a time when he had been practically out of work for five months, though he had walked considerably, and after having taken potassium iodide pretty steadily for four

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months, following a long course of mercury injections given during the winter and one dose of neosalvarsan in January. He got over his cough in May while he was taking potassium iodide. On August 15, 1914, he sailed for Liverpool as seaman on the "Saxonia" and later returned on the "Lusitania." On this trip he carried food cans weighing about 20 pounds, scrubbed forecastles, pulled on hoisting-ropes, and for about one hour handled trunks. During the latter job he had a very little pain, which subsided as soon as he stopped working, otherwise the pain he experienced on this trip was insignificant. On the "Lusitania" he got wet and, having to live in his damp clothes for two or three days, caught cold. He then had cough with thick expectoration in the mornings. His cough continued into November. Around December 5, 1914, he was usually not coughing. From October 5, 1914, to January 5, 1915, he worked on a drill press, which labor, though light, was for long hours. Through the fall up to the middle of December, 1914, he had practically no pain. Then he caught another very bad cold and pain in his chest returned, the pain generally lasting for short periods of time and recurring at intervals of one or more days. After he stopped working in January the pain soon left. While out of work he walked several miles a day. On returning to light work in an automobile shop he had some recurrence of pain.

In January, 1915, he took potassium iodide, grs. v t. i. d., on stopping which his cough got a good deal better. Between November 7, 1914, and January 9, 1915, he was given seven injections of mercury salicylate.

On February 27, 1915, he embarked again on the "Lusitania" as a seaman and returned to New York May 24, during which time he had only one attack of pain and that while working ashore, as a result of which he went to a hospital where he spent three weeks. On his return from abroad he had a cough. He then took some more mixed treatment. After his return he did no work for at least a month. An occasional pain he had during this time he attributed to taking coffee. Around June 23, 1915, he was coughing only a couple of times on getting up in the morning and three or four times during the day.

In August, 1915, his Wassermann being 12 units positive as rigorous a course of antisppecific treatment as his work would permit was instituted. On March 16, 1916, his Wassermann was 5 units positive. Between August, 1915, and April 9, 1916, he was given fifteen injections of mercury salicylate, $\frac{3}{4}$ to 1 gr. each, and on March 16 he was given diarsenol 0.3 g. He also took potassium iodide grs. x t. i. d. most of the time from about the first of September, 1915, to January, 1916. The end of Sep-

tember, 1915, his cough had entirely stopped, but on October 1 he got his feet wet again and caught another cold. About the first of January, 1916, on stopping the potassium iodide, the cough which had been pretty bad became much easier. About the first of February, on resuming the potassium iodide the cough became bad again, so that he stopped this drug and again the cough lessened. Since then no more potassium iodide has been given. After the middle of February the patient got his feet wet on shipboard and took cold, and cough and expectoration again became pretty bad. He now had two or three severe coughing attacks to raise thick expectoration every night. Immediately following the diarsenol on March 16, 1916, the expectoration became thin and much reduced in amount and the cough became much less severe, the night attacks ceasing. Around April 9 his cough was less and he was having only a little expectoration mornings. However, on April 17, with a sudden change of temperature in the work-room, he again caught cold and began again to cough a good deal and to expectorate thick phlegm. While his cough was pretty bad up to the middle of May, disturbing him at night, it then improved so that he coughed only on awaking in the mornings to raise expectoration and very little in the daytime. His own notes state that for two weeks after receiving the diarsenol he had a slight pain at night lasting one-half to one hour. In the month following the taking of this drug he lost six pounds in weight, yet in this time his cough and expectoration had greatly decreased.

In August and September and again in November and December, 1915, he worked on a drill press. On January 24, 1916, he made a trip to Liverpool on a cattle-ship where he carried hay and water to feed the cattle. About the first of March he obtained employment as a marine machinist in which capacity he had to lift up to 20 to 30 pounds. On March 10 he carried about 50 pounds of coal up three flights of stairs without stopping, which made him a little short of wind. March 14 he walked a mile in seventeen minutes. On March 27 he walked about five miles, carrying his tools for two of the miles, and during the last mile he had a little pain over the aneurism. During a part of April, 1916, he worked on a light drill press. From May 1 to May 27, notwithstanding his cough, he put forth great effort. He worked overhauling ship pumps, lifting generally weights of from 10 to 20 pounds, but four or five times a week he would lift a weight of 80 to 100 pounds. On three of these days he did 14 hours of actual work and on nine days 12 hours of actual work. During the last two weeks on this job his cough and expectoration became greatly improved. During the whole time on this job,

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he had only very occasionally a slight touch of pain, lasting about five minutes. On June 3, the patient reported that he was obliged to eat four meals a day to satisfy his appetite. Examination of sputum for tubercle bacilli on May 30 was negative. No signs of apical lesions.

During the past summer (1916) the patient has practically done no work. He took red iodide of mercury pills for about eight weeks. August 24, 1916, Wassermann negative. Toward the end of September he shipped as a deckhand on the "St. Paul." On this trip he had no pain while at work. He was last seen on November 3. Since early summer he has had some cough which has been for the most part dry. During this time except in the hottest season, he has generally walked several miles a day. Often after walking 2 or 3 miles he has had a little touch of pain, which has gone away with resting and to which he has paid little attention. He claims that the eating of fried eggs gives him slight pain. He is looking and feeling very well and has a big appetite.

LATE NOTE.—The patient dropped dead on the street November 16, 1916. Autopsy showed intrathoracic rupture of the aneurism. The aneurism specimen has not yet received a thorough examination.

The writer is indebted to Dr. George B. Wallace for his coöperation in the care of this case.

The Antispecific Treatment of Thoracic Aneurism.—The writer wishes to emphasize the importance of treating the syphilis in thoracic aneurism, as a means of controverting the symptoms and prolonging life. The antispecific treatment must be administered according to rule¹ to obtain good results. The writer's rule is that potassium iodide and mercury must first be administered for four or five or six months before one of the salvarsan preparations or diarsenol is given. Lesser,² of Berlin, states that in treating tertiary syphilis potassium iodide and mercury should always precede the administration of salvarsan. The mercury should preferably be administered by intramuscular injection. The preliminary treatment with the older remedies, combined with rest, has, in not too advanced cases, for a time anyway, attained much for the relief of the symptoms. It is, however, following a long preliminary treatment with potassium iodide and mercury, after one of the salvarsan preparations or diarsenol has been given, that a further betterment is very promptly effected, which is more enduring than that

¹ Lusk: Discussion on Thoracic Aneurism. N. Y. Medical Record, March 27, 1915, p. 540.

² Lesser: Berl. kl. Wochenschrift, March 16, 1914, p. 494.

which can be obtained with potassium iodide and mercury alone. Any cough then diminishes, and pain, if present, is lessened or vanishes and the patient becomes possessed of a sense of well-being not before experienced. In two cases of thoracic aneurism, to whom small doses of salvarsan were given as their chief treatment, at intervals over a period of several months, without the preliminary use of potassium iodide and mercury, the symptoms became aggravated and the patients died. It would seem probable that it is the preliminary control of the gummatous infiltration of the aortic wall by the potassium iodide and mercury which gives particular efficacy to the spirochaetacidal action of the subsequently given salvarsan or diarsenol. In the observation of the writer, in cases of thoracic aneurism pretty generally, it has seemed that, for some time after salvarsan or diarsenol has been administered, if potassium iodide were given, pain would result or cough and expectoration, if present, would be increased. He therefore always stops potassium iodide before giving salvarsan or diarsenol and withholds it for a considerable time thereafter. To one case of thoracic aneurism with a cough, who had had no salvarsan for as long an interval as a year, small doses of iodulose were administered, the giving of which was attended with a marked exacerbation of the cough which became very distressing at night. However, on stopping the iodulose, the aggravation of the cough at once disappeared.

Mercury should be omitted for five days before and for five days after the administration of salvarsan or diarsenol for fear of kidney complications. After one of the latter drugs has been given, mercury seems to take on a renewed efficiency. The writer repeats the salvarsan or diarsenol about once a month, being guided as to the number of injections given by the Wassermann reaction, and in between doses he gives mercury again under the precautions above stated. It is these injections of mercury between the injections of salvarsan or diarsenol that seem to give added recuperation to the patient. The writer had until the past winter used neosalvarsan 0.45 g. since Alwens³ had shown experimentally that neosalvarsan given in proportionately large doses to rabbits was little liable to produce nephritis, while old salvarsan in lesser dosage was very liable to do so. He now uses diarsenol 0.3 g. with which the results in the few cases treated have been entirely satisfactory.

The use of the diarsenol, which is supposably the equivalent of old salvarsan, has seemed to be more generally effectual than was the neo-

³ Alwens: *Archiv. f. Experiment. Pathol. u. Pharmak.*, Bd. 72.

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salvarsan. When, after the primary series of salvarsan or diarsenol has been given to these cases, it becomes necessary to give a subsequent course of antisppecific treatment, if potassium iodide cannot be taken, a course of mercury alone should precede the giving of the salvarsan or diarsenol.

The writer administers the potassium iodide in doses of not over 10 grains t. i. d. He uses the salicylate of mercury for intramuscular injection in doses of not more than one grain, repeating the same generally at five-day intervals. He would call attention to the facts that abdominal cramps and diarrhoea following an injection of mercury are indications for reducing the dose, and that fetor of the breath or swelling of the glands of the neck with perhaps swelling of the tonsil, too, are just as much indications for interrupting the mercury as is soreness of the gums and teeth. With the giving of the diarsenol or salvarsan, the condition of the urine should be watched with particular care.

Without the antisppecific treatment in cases of thoracic aneurism, the relief of symptoms coming on as a result of the wiring operation lasts only for a short time, because the disease in the arterial wall remains unchecked and the aneurism will consequently resume its growth.

In trying to estimate the effect of treatment on the growth of the aneurism in the case of G. S. herein reported, from X-ray plates, it must be noted that of the four illustrations of this case grouped together, Figs. 3 and 5 do not furnish outlines for accurate comparison with the others, since they were taken a little obliquely and therefore throw the shadow a little farther to the patient's left than a direct front to back picture would have. Figs. 2 and 4, however, being both direct anteroposterior views give a fair estimate of the change which had taken place two years after the operation, which consisted in a broadening of the shadow about half an inch as measured in the original plates. The X-ray of May 28, 1916 (Fig. 5), shows a small area of bulging to the left, not before observed.

The patient G. S. has been given considerable potassium iodide. That which he took soon after the operation and before getting his first neosalvarsan was undoubtedly highly beneficial and very necessary. Continuing his mixed treatment during the time he was getting his first three doses of neosalvarsan and for a month thereafter, he seemed to get his greatest benefit following the neosalvarsan, after the mixed treatment had been stopped. This is in keeping with the theory of incompatibility between potassium iodide and the salvarsan preparations.

In the fall of 1913 there was referred to the writer by Dr. C. D. Van Wagenen a case of aneurism of the aortic arch,⁴ whose X-ray picture at that time compared with one taken at the same focus and in the same position 16 months earlier, showed a lateral shrinkage in the aneurismal shadow of from 1 to $1\frac{1}{4}$ inches to have taken place. Also it was found that the physical signs of aneurism of the aortic arch, which has been present in this patient, no longer existed. All the treatment this patient had had was rest, small doses of potassium iodide given very irregularly and a few injections of mercury. Deducing from this result that potassium iodide might be able to cause diminution in size of an aneurism, beginning on March 16, 1914, the patient G. S. was given small doses of potassium iodide over a period of 5 months. This dosage was instituted just following a long course of mercurial injections and one dose of neosalvarsan given the preceding January. While the patient was taking this potassium iodide he practically was doing no work, though he walked considerably, and after the fourth month of this medication his health was excellent and he had no pain or cough. It was just about this time that the X-ray picture shown in Fig. 4 was taken. Besides this course of potassium iodide, he had had another one of particular length previously from September 30, 1912, to March 15, 1913, and received still another subsequently from about September 1, 1915, to about January 1, 1916. Following the course of potassium iodide given in the spring and summer of 1914, whenever resort was had again to potassium iodide he either had, or developed, a cough which would seem to be aggravated by this drug, since on stopping the latter the cough would always get better. Finally (February, 1916) further attempt to give potassium iodide was given up on account of its baneful effect on the cough. In some cases of thoracic aneurism, cough seems to be increased as a result of the long continued use of potassium iodide irrespective of the taking of salvarsan or diarsenol, the appearance of which manifestation probably signifies that the limit of tolerance to this drug has been reached. The X-rays show no evidence of gross shrinkage in the size of this aneurism as a result of the treatment.

In one other case, a mesially situated aneurism of the arch, in which careful comparisons were made of X-ray plates before and after a six-month interval in which the patient had rested and had received 29 injections of Hg salicylate from $\frac{1}{2}$ to 1 grain, and small doses of potassium iodide for a large part of the time, the shadow was found to have remained the same size. This patient up

⁴ Lusk: *ANNALS OF SURGERY*, lx, 1914, p. 535.

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to that time had had no diarsenol or salvarsan. Thus it can be argued that potassium iodide in small doses will not extensively diminish the size of an aneurism.

When one thinks about it, it is hardly to be expected that a diseased aorta considerably converted into adventitious tissue, which has dilated, can possibly become very much reduced in size, even under circumstances most favorable for the healing of the gummatous infiltration and the destruction of the spirochaetes. A slight shrinkage however as a result of the control of the disease and the reduction of spirochaetal activity, could explain the relief of symptoms following treatment. Yet the enlargement of the aneurism in the case of G. S. within the first two years following wiring (Fig. 4) would seem to indicate that a certain amount of accommodation of the surrounding tissues to the pressure of the tumor may take place. Recent descriptions of the pathological anatomy of syphilitic aortitis have been published by Symmers and Wallace and by Longcope.

The writer is inclined to believe that in cases of mesially situated aneurism of the aortic arch, who suffer from acute dyspnoeic attacks associated with sudden great pressure on the trachea, and who become greatly alleviated or relieved shortly following the administration of morphine and atropine, the existence of a mediastinal cedema can be offered as a rational explanation of the sudden acute symptoms. There is usually in these cases an area of superficial veins on the upper part of the front of the chest which, like a tell-tale, remain congested while the symptoms are more or less acute. In a case of this sort recently treated medically, the paroxysms of acute dyspnoea were promptly relieved by a hypodermic of 10 minims of adrenalin, which result would favor the theory of a mediastinal cedema being the cause of the acute pressure on the trachea. Relief, which was marked and more lasting than that obtained by any other means, was given to this patient by an injection of neosalvarsan 0.45 g., which, however, came after considerable antispecific treatment had already been administered. In the case referred by Dr. Van Wagenen, the subsidence of a mediastinal cedema might explain the very large reduction in size of the X-ray shadow corresponding to the thoracic aorta.

Dr. G. Reese Satterlee⁵ has reported a case of thoracic aneurism to whom he began to give antispecific treatment in May, 1911, and who, Dr. Satterlee advises me by personal communication, is to-day (June, 1916) living in comfort and doing light work. The patient was early

⁵ G. R. Satterlee: N. Y. Medical Journal, Jan. 13, 1912.

given two small doses of salvarsan, besides which to date he has had 125 intramuscular injections of mercury, and with the intermission of a year, he has been given 90 grains of potassium iodide a day continuously since treatment was begun. Dr. Satterlee, in his report, described a penumbra seen with the fluoroscope, lying to the left of the shadow of the arch, which he interpreted as being a probable "syphilitic deposit" skirting the aneurism. He says that a year ago the penumbra was still present, though of a lesser density than in the beginning.

The Operative Treatment of Thoracic Aneurism.—The antispecific treatment cannot be relied upon to cause strengthening of an aneurismal dilatation much weakened by stretching. It is to offset or to forestall the growth of a weakened aneurismal area of this sort that the Moore-Corradi operation of wiring with electrolysis is indicated, as a result of which, if a clot can be thrown down on the inner surface of the dilated area, a means of repairing the latter is thereby furnished which will rapidly bring relief to the symptoms, and will probably cause shrinkage of the local tumor. Aneurisms not compressing the trachea, which are very large or prominent and therefore liable to rupture, are suitable ones for early wiring. The median aneurisms which press on the trachea with sufficient force to compromise the breathing are still a study. Unless too far advanced they seem to do well with the anti-specific treatment alone. The writer has wired two of these cases. One of them, treated afterward with the antispecific remedies, lived for about $3\frac{1}{2}$ years, and the autopsy showed that the wiring had accomplished nothing. The other case had a sacculum projecting above the manubrium, in which a clot formed as a result of the operation and the patient died soon after the operation from tracheal obstruction.

A principle in the technic of the wiring operation to be emphasized, is that of contact of as much as possible of the introduced wire with the inner surface of the aneurismal wall, since clot produced by the electrolysis in the course of the wire, in order to find permanent lodgment where it can undergo organization, must be deposited on vitalized tissue to which it can adhere. A coating of fibrin which is laid down by the electric current on that portion of the wire which projects free into the swiftly-moving blood stream soon becomes loosened from its attachment, leaving the wire bare. The localities within an aneurism where the blood is most likely to become clotted by an electrified wire, are where the aneurism is recessed, at which situations close to the aneurism wall the aortic blood current must be slowed to a greater extent than anywhere else. If no recess should exist, as in cases where the dila-

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tation of the aorta might be a purely fusiform one, then the efficacy of the wiring operation would be in question, from the probable inability of a suitable clot to form in the presence of very rapidly-moving blood. In the case of G. S. the position of the wire shows that the first portion of the aorta was simply dilated to the left into a recess, the recess forming a part of the main conduit for the blood, thus demonstrating that the aneurism need not necessarily be a purely sacculated one for the wiring operation to be of avail. A recess would naturally correspond to a site of weakening of the aneurism wall, since it is at such situations that the most stretching has taken place. Consequently the recesses are the sites needing to be strengthened. Since the prominence of the aneurismal tumor, where the puncture with the insulated gold needle is made, generally indicates the site of a recess, the wire must be manipulated by shaping in such a way that some of the loops as they are introduced will come back so as to touch the area of sac wall adjacent to where the needle point has entered the cavity. In order to manipulate the wire from without in a way to control in a measure its arrangement within the aneurism, a resilient wire is used, the "clasp" gold wire⁶ No. 29, which being properly shaped before operation, will after passing through the needle regain its shape within the aneurismal cavity. To favor the coming back of the wire during its introduction so as to make contact with the aneurism wall around the site of entrance of the needle, it was found by tests in a glass flask, that if a loop of the wire, shaped so as to have a smaller diameter than that of the flask, were interposed between about every two larger loops, having a diameter greater than that of the flask, than each smaller one, when first introduced, posing within the flask under little or no restraint other than that of the wire with which it was continuous, would tend to assume a position about in a plane passing through the long axis of the shaft of the needle. As the larger loops of the wire now followed each smaller one, the latter would become expanded as far as the confines of the cavity would permit, and, lying in the plane above mentioned, as it expanded it had to retrieve to alongside of the needle point. This interposition of smaller between larger loops of the wire has seemed to establish a varying direction for the loops, resulting in a more or less general peripheral arrangement of the wire than when the wire is shaped in loops all of a diameter which is larger than that of the aneurismal cavity.

In order to bring as much wire as possible into contact with the aneurism wall, the wire, first straightened, should be shaped in undulat-

⁶Lusk: A Thoracic Aneurism Treated with Gold Wire and Galvanism. ANNALS OF SURGERY, June, 1912, pp. 789-803.

ing curves, and then this undulated piece of wire again curved so as to form loops. The peripherally lying crests of these undulations have a better chance of making contact with the aneurism wall than a wire of one even curve would have, both by their being better able to fit the irregularities of the cavity and as well by being able to dip down through the interlacement of the loops of wire already laid down. In the last case wired, the crests of the undulations were somewhat flattened with a view of securing contact of a greater length of wire than could be gotten with a crescentic shape. The undulated wire allows more give and therefore takes a peripheral arrangement under less tension than does a wire curved evenly in large loops. Also the undulations as they interdigitate make a deeper mesh of wire to possibly aid in the entanglement of blood clot at the wall of the cavity. The entering extremity of the wire is always shaped in an expanding spiral so that it will come back toward the needle point as it enters the aneurism and lodge free in the central portion of the cavity. The portion of wire which is last introduced and which is to be left in the needle track after the needle has been withdrawn, should be straight, and the portion of the wire introduced just in advance of the straight piece should be shaped in a couple of very small loops which will lie free within the cavity of the aneurism, thus relieving all tension from within on the terminal portion of the wire which is left buried in the chest wall. The first time the writer used the undulated wire on a case of aneurism, the needle was found to be of too small a bore to allow the free passage of the undulated wire, which feeds in under much greater resistance than does the evenly-curved wire, so that finally with the clotting of the blood in the needle the wire jammed. After withdrawing the needle the piece of the wire left in the needle track tended to regain its undulated form, thus exerting pressure on the adjacent tissues, which caused necrosis along the track of the wire, and this in turn was followed by rupture through the skin and death of the patient from hemorrhage. The larger loops are generally shaped so as to have a diameter of about 5 inches, and the smaller loops, a diameter of about $2\frac{1}{2}$ to 3 inches. Four cases of thoracic aneurism have been wired, using the undulated wire with the smaller loops interposed between the larger. Of one of these patients whose aneurism formed a small prominent tumor on the front of the chest, and in whom a No. 30 wire was used, it was reported three and a half months after the operation, that the tumor had receded so that the chest wall was flat. Another of these patients, who died with symptoms of cerebral embolus, had a broad clot adherent to the wall of the aneurism underlying the area through which the puncture

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with the needle was made, and in the clot considerable wire was embedded. In the third case hardening of the aneurism around the site of puncture ensued. The fourth case, who had a pulsating tumor which projected quite high from in front of the sternum, died from rupture four and a half months after the operation. At autopsy it was found that there was an extrathoracic expansion of the aneurism which communicated with the intrathoracic portion by a perforation through the sternum about $1\frac{1}{4}$ inches in diameter, through which bony opening the wire had passed to become deposited within the intrathoracic portion, in the recesses of which organized deposit was found entangled in the peripherally located wire. Thus the extrathoracic portion of the aneurism got no protective clot formation within it, yet the external tumor primarily following the operation receded very much in size. In the two latter cases the current used was 100 ma. for 30 minutes.

The autopsy in the last case just cited, has shown that the current of 100 ma. electrifying the introduced wire for thirty minutes, caused a good deposit to be laid down in those localities in which it was possible for deposit to form, which had undergone organization. The writer also is inclined to believe from his experimental work, that, with the use of a current of 100 ma. for thirty minutes, less extraneous fibrin will be deposited during the electrical séance on the portion of wire in relation with the very rapidly flowing blood, than there would be with the sequence of 100 ma., 50 ma., 40 ma. and 30 ma. each for fifteen minutes, as heretofore used. The writer advocates making the wire grease-free, since in dogs a grease-free wire produces the more reliable clotting. The wire when first straightened out before being shaped, should have the grease from the shop removed from it by stripping it with gauze wet with alcohol. When the wire has been shaped and is coiled ready for use it should then be boiled in a 10 per cent. to 15 per cent. washing soda solution for further removal of grease, then rinsed in plain water to remove the soda, and finally boiled once or twice more in distilled water.

The writer has wired the aortas of 239 dogs in the surgical laboratory of the New York University and Bellevue Hospital Medical College, to which institution as well as to Dr. Richard M. Pearce, former Professor of Pathology, Dr. John W. Draper, Associate in Experimental Surgery, and Prof. Douglas Symmers personally, he is indebted for many courtesies in the course of this work.

CHRONIC CYSTIC MASTITIS OR ABNORMAL INVOLUTION OF THE BREAST*

BY PARKER SYMS, M.D.

OF NEW YORK

THE condition I have chosen for my topic is a complex one. Of its etiology, we know very little or nothing. The histological changes are of such a variety that the disease has received a great many names, most of them indicative of some characteristics of the pathological changes; and these changes vary so much in different cases that an observer is very apt to give a name to the process depending on those changes which have appeared most prominent and conspicuous in the cases he has studied. For instance, it has been called interstitial mastitis because of the over-development of the interstitial fibrous tissue of the gland; it has been called cystic mastitis on account of the abundant cyst formation; it has been termed a form of adenoma on account of the abnormal development of the epithelial structures; it has been spoken of as an epithelial cirrhosis (Quenu), a chronic cystic mastitis (Koenig), cystic disease of the breast (Reclus), cyst-adenoma of the breast (Schimmelbusch), abnormal involution of the breast (Warren), senile parenchymatous hypertrophy (Bloodgood), fibroma mammae tuberosum or lobulare and also interstitial mastitis (Virchow), and as chronic mammary tumor (Astley-Cooper).

Sometimes certain portions of the breast will be occupied by more or less distinctly defined masses or tumors; then a general chronic cystic mastitis may be overlooked and the diagnosis of adenofibroma may be made if the connective tissue predominates, or of fibroma-adenoma, if the epithelial or glandular structure predominates.¹ In its proper place, I feel that it will be well to go quite fully into a description of the pathohistological changes which take place.

* Read before the New York Surgical Society, October 25, 1916.

¹ The following incomplete list of titles which have been given to this condition illustrate the above statement. Noticeable is the case of Koenig, who was prompted by one series of cases to call it interstitial mastitis, and by another series of cases to call it chronic cystic mastitis. Chronic mammary tumor, Astley Cooper; cystic disease of breast, or intra-acinous cystic epithelioma, Reclus; epithelial cirrhosis, Quenu; interstitial mastitis, Koenig; chronic cystic mastitis, Koenig (1893); nodular mastitis, Phocas; *maladie noueuse*, Phocas; fibroma mammae tuberosum or lobulare, Virchow; cystadenoma, Schimmelbusch; mammary cirrhosis, Wernher, Billroth; cystic epitheliomata, Lacoulet; papillary epitheliomata, Cornil; chronic mastitis, Lockwood and others; mastitis chronica

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Etiology.—As I have said, we know very little, almost nothing, of the causation of the disease. We know that it occurs in women, usually after the thirtieth year; it occurs among women who have borne children, among married women who have not borne children, and among single women who have not borne children. It also occurs in men. In one male patient of mine, it developed in each breast, and each breast was removed (some years apart) on account of the evidences of rather rapid development. Owing to the fact that it usually takes place between the thirtieth year and the period of the menopause, and owing to certain of its pathological characteristics, it has very appropriately received the term of abnormal involution. Again, owing to the fact that it develops during the age period just cited, it represents a change taking place in the breast during the actual cancer period.

Owing to the remarkable changes which take place in the epithelium, and the fact that a large proportion of these cases become cancerous, it is proper that it be considered as one of the precancerous conditions.

Acute mastitis sometimes precedes the development of this chronic form, and it doubtless is an etiological factor in a small proportion of the cases.

There is little if any evidence to show that traumatism has acted as a causative factor in this condition. The breasts are constantly liable to slight traumatism and to irritation, and of course, the breast itself is essentially an inverted portion of the skin, and there is no doubt that some forms of irritation may be directly transmitted to it.

Being an inflammation, we must assume that the phenomena are really a series of responses to some form of irritation, either mechanical, bacterial, or chemical. The physiology and even the structure of the breast are strongly influenced by diseases of the female pelvic organs. There are some who claim that all such hyperplastic inflammations are caused by toxins produced in the stagnant bowel—in other words, that they are due to auto-intoxication, the result of fecal stasis.

To my mind, it is more likely that we shall find its explanation in the very unstable nature of the structures of the gland itself, and in the very unstable nature of the physiological functions of the gland. If one will bear in mind the fact that the mammary gland goes through many changes, in both its function and its actual structure, then one will see that it is easily possible for this change to extend beyond the

fibrosa, L. Gelpke, C. Schlatterer; epithelial polycystoma, Sasse; fibrous and glandular hyperplasia with retention cysts, W. F. Whitney; senile parenchymatous hypertrophy, Bloodgood; abnormal involution of the breast, Warren; mastite de la menopause, chronic diffuse mastitis, Baumgartner and his French colleagues.

range of normality and to enter into the domain of disease. The mammary gland has a transient function and it *almost* has a transient existence. It is not fully established or developed until after the age of puberty. About that period of life, it undergoes a great metamorphosis. It is subject to similar changes at every menstrual period—though of course to a limited degree. During pregnancy a complete change takes place in the gland, and during lactation the gland assumes an entirely new proportion and of course takes on an entirely new function. Every structure of the gland is altered. After the function of lactation has ceased, the gland undergoes an involution, when the tissues are again being transformed and changed in a remarkable degree.

After the menopause, comes the period of involution and atrophy, the usefulness of the gland having ceased.

So, it will be seen that the mammary gland, throughout life, is subject to rapid evolutions and involutions, with constant changes in its actual tissue; so that the component structures of the gland are extremely varying in their relations one to the other, and extremely varying in their inherent composition and structure. For instance, a fully developed gland has structures which would be absolutely abnormal for the same gland before puberty, and a lactating gland has structural arrangements which would be absolutely abnormal during the quiescent period.

The epithelium is singularly unstable and subject to change in both its quantity and its quality, and in its relation to itself and to the other structures of the gland. Of course, anything that disturbs the equilibrium of these changes which take place within the range of normality may lead to an overproduction of any or of several of the structures in such a manner as to result in a condition of chronic cystic mastitis with more or less tumor formation. Rodman advances the theory that miscarriage and abortion may be responsible for the initiation of many of these cases. Abortion represents a sudden and unnatural interruption of functional and structural evolution.

There is a singular analogy between this condition and the condition commonly known as senile hypertrophy of the prostate. Senile hypertrophy of the prostate is really a chronic cystic prostatitis. The prostate gland is subject to great physiological excitation, and its structures take on much the same changes as do those of the breast, and when the so-called hypertrophy takes place we find very similar pathological changes in it, and the two conditions are similar in their liability to transformation into cancer.

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Pathology.—As I have said before, each observer who has given a name to this condition has been actuated by the special changes in the structure which have been most prominent in the cases he has seen. Perhaps each of the names cited above is correct in so far as it suggests or defines at least one phase of the process. It will be seen that some authors have considered this to be purely an inflammatory process; others have considered it entirely hyperplasia; while still others have seen only the evidences of tumor formation.

Probably no one name in the entire list given above is sufficiently comprehensive, except the indefinite one of Warren, namely, abnormal involution of the breast. Whitney has probably come nearer to it than any one, and his title would have been correct had he amplified it thus—chronic mastitis, with fibrous and glandular hyperplasia with retention cysts. The disease is undoubtedly primarily an inflammation. The various pathological changes found represent either distinct stages of the disease, or its development according to certain tendencies. Thus, different cases of this one disease will represent a great variety of processes, and it is also true that we will find different parts of the same breast showing a variety of pathological changes, almost contradictory in their character. The inflammation affects the glandular structures, and it is manifested in the lobules and in the lobes of the gland. As it affects the glandular structures more than it does the ducts, it will be found most prominently in the periphery of the breast. It is characterized by proliferation of the glandular epithelium and of the fibrous tissue which comprises the stroma of the gland. One of its chief characteristics is the formation of cysts. These cysts vary in size from that of a millet seed to that of an orange. Various theories have been advanced as to the manner in which these cysts are produced. Some claim that they are purely retention cysts, that they are accounted for by the over-production of the fibrous tissue of the canals and ducts, with obliteration of their lumen, by stricture formation, and that they are simply retention cysts behind these strictures. Others claim that they are formed by the breaking down of fibrous septa between acini and ducts, with their consequent coalescence; thus two or several acini become one cyst cavity. Again, others claim that they are the natural result of actual epithelial hypertrophy and proliferation, with ultimate desquamation and degeneration of the cells. Normally the acini and canals are lined with a single layer of epithelium of the cuboidal type.

In this form of chronic mastitis, there is a very active change in the epithelium; there is a change not only in the character of the cells, but a great increase in their numbers, and several layers become super-

imposed one upon the other ; they become arranged in cylindrical masses, clumps of them being detached so as to form actual fringes or papillary masses within the cavities. In many respects this is not very different from the changes which take place in the epithelium during the period of lactation. The hyperplasia which takes place in the fibrous tissue may be the predominating element, the walls of the acini, the ducts, canals, and canaliculi becoming thickened and fibrous. These over-productions may appear like tumor formations, but they do not progress to isolated and encapsulated tumors ; they are more like tumorous masses. In these tumor-like masses, we find examples of so-called adenofibroma, or fibro-adenoma, depending upon whether there is a predominance of the fibrous tissue or of the glandular elements.

The phenomenon with which we have to concern ourselves mostly is the behavior of the glandular epithelium. It depends upon just how far these cells depart from the normal (in certain particulars)—whether or not transformation into a carcinoma has or has not taken place. Undoubtedly, the determining point is the fact that masses of epithelial cells have so infiltrated the surrounding structures that they have penetrated their basement membrane. This corresponds with Adami's definition, which is as follows :

We regard as cancer all cases in which there is infiltrative, and apparently independent, growth of epithelial or gland cells into the surrounding tissues, and this whether of only slightly atypical or markedly atypical cells.

Microscopic examination of specimens from a series of cases and of different parts of the same specimen will show that the epithelium can go through a very wide range of changes without evincing cancer, and will show the final steps in epithelial derangement which constitute the actual transformation into carcinoma. In this connection, we may find that there is a hypertrophy of the cells ; we do find a hyperplasia, that is to say, an increase in the number of cells ; then we find disorderly arrangement of the cells ; we find the cells in a condition of potential or of actual growth, as evidenced by an increase in the size of their nuclei ; we find atypical forms of cells ; we find the cells displaced, so that there is an abnormal arrangement of the cells, in their relation to surrounding structures and in their relation one to the other ; and, lastly, we find penetration of the cells through their basement membrane. There may be rupture or loss of basement membrane. This is cancer.

In different parts of the same breast, we will find these epithelial changes in different stages, and thirty or forty different sections may have to be examined before one will discover a spot where actual trans-

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formation into carcinoma has taken place. The part which has become carcinomatous is a cancer; the parts which have not become carcinoma are potential cancers, or are in precancerous states.

In reviewing and summing up these processes, it will be seen that the disease is a very complex one. It consists of a chronic inflammation, of hyperplasia of certain of the structures, of the production of fibro-epithelial tumors—which are really more than hyperplasias—and, finally, of the production of cancer. There is no doubt that these various histological changes really represent progressive stages of the disease. In his admirable book on "Pathology," Adami expresses this very clearly as follows:

There are obviously individual differences in reactive and regenerative powers, and these differences, in other words, the tendency to excessive cell growth, is an all-important factor in determining whether a given insult to the tissues leads merely to an orderly regeneration or to tumor growth. But it is equally clear that simple irritative and regenerative hyperplasia, adenomatous growth, and carcinoma, are stages which can be manifested in succession by the same tissue; that the differences are those of degree and not of kind.

Fortunately each case does not go through this entire gamut, or obviously each case would ultimately become a cancer, but a sufficient proportion of cases do follow this course to make us properly consider this condition as one of the precancerous states. We must bear this in mind when we come to the question of treatment.

Symptoms.—The symptoms of this disease are about as follows: There is tenderness, sometimes pain, in the breast affected; the disease is frequently bilateral. It is characterized by more or less indistinct swelling of the breast, often amounting to distinct tumor-like masses. The lesions are found principally at the periphery of the breast. There is seldom great increase in the size of the organ. It is more a change in texture than a hypertrophy. It is most common after the thirtieth year, up to the time of the menopause. There is seldom evidence of an active inflammatory process, such as heat, redness, etc.

The disease is usually discovered by the woman noticing a swelling in some portion of her breast; perhaps her attention has been directed to it on account of a sense of uneasiness or of actual pain or tenderness. Retraction of the nipple is not a characteristic nor a part of this disease, neither is adhesion of the skin nor fixation of the gland to the deeper structures.

The progress of the disease is slow and chronic, but it is not steadily progressive. Sometimes there are intermissions. Koenig has called attention to the fact that new nodules develop at each menstrual

period. After the menopause, complete atrophy may take place, by the over-production and contraction of fibrous tissue—the mammary cirrhosis of Wernher.

During the earlier stages, more or less resolution may take place, but when there has been much hyperplasia, especially with the formation of tumor-like masses, restitution to the normal can hardly be conceived. The disease may reach a certain height and remain stationary, or it may undergo transformation into carcinoma.

We have shown how chronic mastitis may vary, not only in degree but also in character; how it may represent merely a chronic hyperplastic inflammation, or how it may become more than a hyperplasia, an actual benign tumor formation—fibro-adenoma or adenofibroma—and how it may produce a cystoma or cystadenoma, and also how the epithelial changes may progress beyond these innocuous forms into the generation of cancer. Have we any means of determining clinically just what pathological change is present or is taking place? In a way, we have not. We have no reliable statistics to show just what proportion of these cases become cancerous. Some authors who have gone into this question have not given statistics, but lay stress on the fact that cancer is likely to develop. Those authors who have given statistics have varied greatly. I quote a few as follows: Greenough and Hartwell place it at 10 per cent.; Warren at 13 per cent.; G. Verga found 5 cases of cystic mastitis with cancer among 28 cases of tumors in the breast; Lockwood, in 40 cases, found 8 cases of cancer, and 3 which he marked as suspicious, making more than 20 per cent.; Finney, quoting others, placed the proportion of cancer as from 10 to 50 per cent.

Some clinicians have been vague as to statistics, but emphasize the fact that we should be on the lookout for evidences of transformation into cancer, but they do not tell us what evidences we should look for, nor what are the signs of cancer development in these cases. Of course, it may be assumed that any new and unaccountable activity in a breast which has long been the seat of a chronic mastitis should be regarded with suspicion and treated accordingly. Some claim that we should always regard this condition as being a precancerous state, and that we should always treat it as such—that is to say, treat it as a potential cancer by unsparing ablation. Others claim that we sufficiently perform our duty to the patient if we remove apparent tumor formations, for instance, by means of the plastic operation of T. Gaillard Thomas. Some advise that we should remove these isolated tumors and subject the specimen at once to microscopic examination by the aid of a frozen section, and if the microscopist pronounces it to be cancerous that one

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should immediately proceed with the radical operation for removal of the breast, pectoral muscles, lymphatics, and all.

As pointed out by Bloodgood, this is presenting itself to the surgeon as a new problem. Heretofore surgeons have been seeing breast tumors not early, but late, in a state of full development. The ever-increasing knowledge on the part of the general practitioners and the instruction that is being given to the public through the organized cancer campaign are bringing about a new state of affairs, and we surgeons are beginning to see these cases during their early periods when they are in a condition to which we have been more or less strangers in the past. Our statistics will have to be revised. Twenty cases of cancer in a hundred cases of chronic mastitis seen by the surgeon will perhaps be reduced to ten or to five in the next group he sees. Our perplexity will be greater, but our comprehension of the subject will be much increased.

On looking over the literature, and I have made an extensive research of it, I find that there is not that unanimity of opinion which we would expect. I feel that the proposed treatment, as outlined by many, is not a logical sequence of their own statements.

To my mind, we should regard this condition of chronic cystic mastitis as more than a possible cancer. We should regard it as a pre-cancerous condition, and each case should be considered as a potential cancer; we should perform a radical ablation of the breast. I believe that simple amputation of the breast is not so effective. The radical operation is all that its name implies, and it is no more mutilating, no more disfiguring, and no more dangerous than the lesser and less effective procedure.

If we pursue this plan, we shall certainly sacrifice some breasts that might have been preserved, and we shall sometimes perform a major operation that is not necessary, but it will result in the greatest ultimate conservation. In other words, we shall operate in some cases where cancer would not have developed, in some cases of unrecognized cancer already in existence, in some cases in which cancer is imminent and in which it would develop, but by treating all these cases in this manner we may have 100 per cent. of success as far as cancer is concerned.

On the other hand, if we watch these patients and endeavor to detect signs of cancer formation, we shall be making many mistakes, for we have no accurate knowledge of any clinical signs upon which we can rely. We do not know the symptom or symptoms which indicate that cancer transformation is taking place or has taken place. If we attempt to treat these cases by partial operation, I mean by the removal of one or more prominent tumor-like masses, we shall be making mistakes. In a

certain proportion of cases we shall be removing benign tumors and leaving malignant growths behind.

If we depend on removing a small portion of one of these glands and subjecting it to immediate microscopic examination by the frozen section, we shall be misled in at least a small proportion of cases.

Permit me to quote something pertinent which I recently published on this phase of the subject:

This is one condition where frozen sections should not be relied upon. If one were to depend upon a frozen section, made at the time of operation, to determine whether or not he should do a radical operation, he would necessarily make many mistakes. We must rely on the clinical evidences and on our general experience. In these cases the transition into a cancer may be evidenced in only one part of the gland, and it is a fact that a pathologist will frequently make twenty or more sections from different parts of such a breast before he happens to find one that demonstrates cancer. If that be so, the chance will be twenty to one against a correct diagnosis.

I recently reported such a case before the New York Surgical Society. This woman came to me with a typical chronic cystic mastitis, with a well developed fibro-adenoma in the upper and outer quadrant of the breast. Depending on clinical evidence alone, and guided by my own convictions in this matter, I performed a radical ablation of the breast after the method of Willy Meyer. The specimen was sent to our laboratory; several sections were made, and the pathologist reported the tumor to be a fibro-adenoma and that there was no evidence of cancer found in the breast. Some weeks later I wished to study the sections he had made, and fortunately they had been lost. I say fortunately, because new sections had to be made for our purpose, and one of these showed epithelial changes which the pathologist reported as being distinctly cancerous. Of course, this is not a rare occurrence, by any means, but it certainly shows how unreliable would be the examination of a small number of frozen sections made at the time of operation.

I must confess that this presents to me a very difficult problem each time I am confronted with it. It is often difficult to bring ourselves to apply a general rule to an individual case. When we see a patient who has apparently not progressed to the stage of cancer formation, we naturally hesitate to advise such a mutilating procedure as is the radical operation. We are very much tempted to the non-disfiguring procedure of removal of the prominent tumor mass by means of the plastic operation of Thomas, but if we yield to this temptation some cases will undoubtedly give cause for regret. Early radical operation will result successfully in 100 per cent. of cases. The waiting and watching policy, or treatment by the incomplete operation, will result in a certain percentage of failures.

The micro-photographs (Figs. 1-10) which I am using to illustrate the pathology of this condition, I think are of particular interest. The

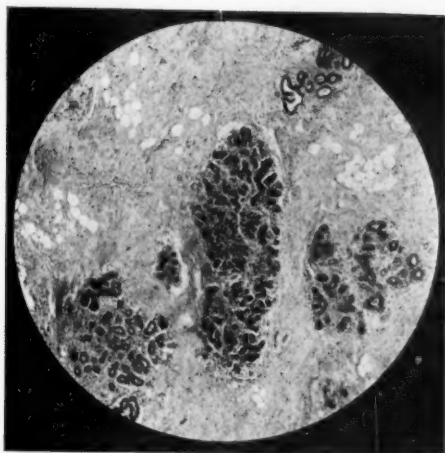


FIG. 1.—Normal adult breast, showing typical lobule with the normal proportion of fat cells, and with ducts of normal size. There is some increase of the fibrous stroma, no more than may be found in a normal adult breast.

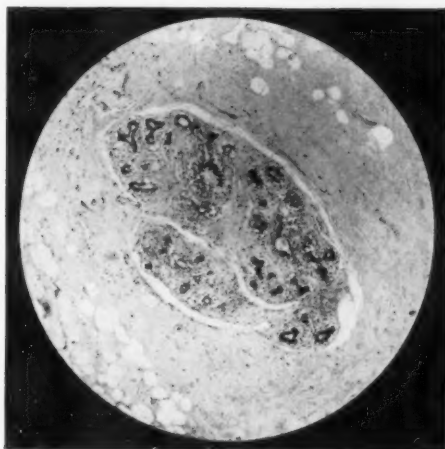


FIG. 2.—Section from same breast as Fig. 1, showing distinct fibrosis; abnormal involution. The glandular elements are compressed by the markedly increased acellular fibrous tissue.

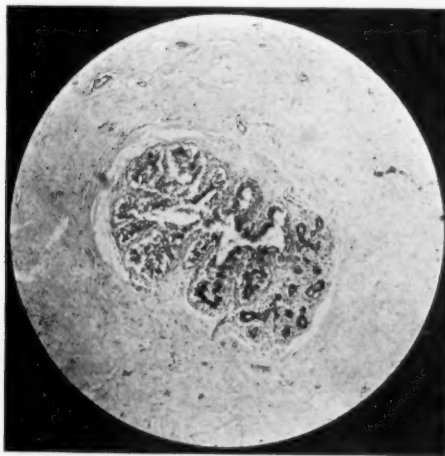


FIG. 3.—Section from same breast as Fig. 1, showing distinct fibrosis, a diminution of fat cells, a large duct showing atypical proliferation of the lining epithelium.

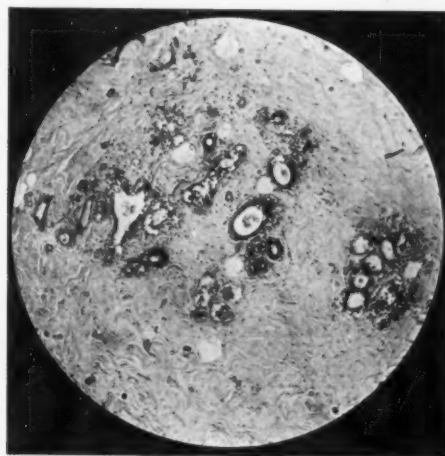


FIG. 4.—Section from same breast as Fig. 1, showing fibrosis, atypical proliferation of epithelium, early stages of cyst formation.



FIG. 5.—Section from same breast as Fig. 1. Precancerous condition, fibrosis, atypical proliferation of epithelium, producing definite epithelial plugs in dilated alveoli.



FIG. 6.—Section from same breast as Fig. 1. Precancerous condition, fibrosis, atypical proliferation of epithelium, epithelial plugs in dilated ducts and alveoli with papillary overgrowth of epithelium in ducts.



FIG. 7.—Section from same breast as Fig. 1, showing typical intracanalicular adenofibroma.

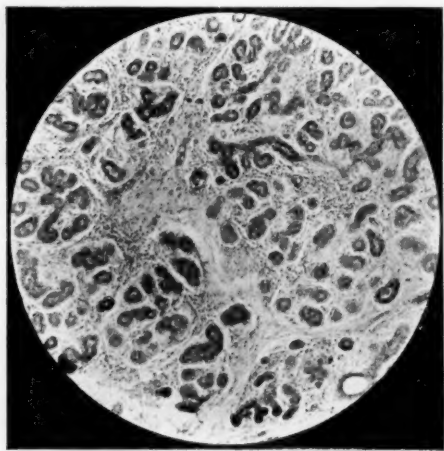


FIG. 8.—Section from second breast. Typical chronic mastitis showing round-cell infiltration and cellular stroma.



FIG. 9.—Section from same breast as Fig. 8, showing chronic mastitis with cyst formation.

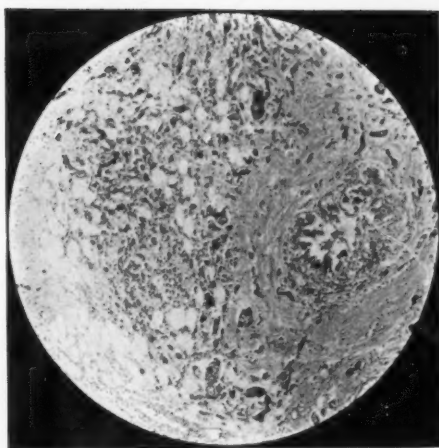


FIG. 10.—Section from third breast, showing early small alveolar carcinoma of breast stroma infiltrated by tumor cells.



CHRONIC CYSTIC MASTITIS

first seven pictures are made from sections taken from different portions of the same breast. They illustrate very beautifully the variety of processes spoken of in the text, and they bear out the theory that these various processes represent stages of development, or else development in accordance with certain tendencies as suggested by Adami. Sections taken from this one breast show the progressive character of the disease, so that we find one section showing normal breast tissue, another showing slight fibrosis (abnormal involution), another showing fibrosis plus atypical proliferation of the epithelium, others showing still further development characterized by cyst formation, others showing pre-cancerous changes characterized by a more marked overgrowth of epithelium, by hyperchromatism, and by disorderly arrangement of the epithelium. One section showed actual cancer as positively diagnosed by a competent pathologist. Unfortunately I have lost this slide.

These first seven pictures were taken from a breast which has been the cause of considerable disagreement—one pathologist pronouncing the breast to be entirely free from evidences of malignancy, the same pathologist as a result of another examination pronounced it to be the seat of fully developed cancer, another pathologist found in it the evidence of chronic cystic mastitis only, with no evidence of pre-cancerous changes, and another pathologist found definite evidence of precancerous changes.

To my mind these sections show positively how unwise it would be to rely upon an examination made by means of frozen sections. On this breast alone I would rest my case in the very positive attitude I take on this question.

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REGRESSIVE CHANGES IN THE BREAST

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IN the period covered from June, 1915, to August, 1916, we have records and specimens of 76 operations performed for tumors and lesions of the breast by operating surgeons connected with the New York Post-Graduate Hospital.

The clinical data obtained from the recorded case histories and examinations in these breast lesions have been carefully studied in connection with the pathological specimens received in the surgical laboratory.

The histopathological studies and findings have been made by Professors MacNeal and Taylor in the pathological laboratory.

An analysis of the 76 cases in which diagnoses were made and proven shows rather strikingly the fact that during the last 14 months (when our studies first began) the percentage of frankly malignant lesions of the breast receiving surgical treatment has been greatly reduced, and that during the same period a corresponding increase in the percentage of benign conditions that have been treated by less radical surgical measures has been recorded.

In the series of 76 observed cases covering June, 1915, to August, 1916, 38 lesions, 50 per cent. were found (from an associated study of the clinical, gross pathologic and microscopic pictures) to be definitely benign.

What is meant by definitely benign here is that in no cases were known malignant changes present.

A separate grouping for the so-called precancerous, or potentially cancerous, conditions has not been made, all of the lesions are reported as either malignant or benign.

Thirty-eight or fifty per cent. of the breast tumors were found to be frankly malignant, a reduction of about 30 per cent. from text-book statistics.

This reduction in the percentage of malignant tumors receiving surgical aid is not so low as recently reported by Bloodgood from the Johns Hopkins Hospital. In that institution during 1913 to 1915 the percentage of increase of benign lesions had risen to 59 per cent., thus reducing the malignant to 41 per cent. Bloodgood regards scirrhus,

GEORGE BARRIE

medullary and cancer cyst types of carcinoma as the terminal or fully developed forms of cancer of the breast, and the adenocarcinomata as earlier and less mature forms. His most recent figures (statistics since 1913) show percentages of fully developed cancer in relation to the other forms of breast carcinoma as 78 per cent. Our percentages covering the same type lesions during 1915-1916 are 72 per cent.

The 38 benign and 38 malignant breast lesions (total 76) are grouped under their respective headings as follows:

Malignant:

Scirrhus carcinoma	16 cases
Adenocarcinoma	9 cases
Medullary carcinoma	7 cases
Adenocarcinoma, cystic	2 cases
Carcinoma, recurrent	3 cases
Sarcoma	1 case

Benign:

Chronic cystic mastitis	18 cases
Intralobular fibromyxoma, intra- and pericanalicular..	5 cases
Papillary cystadenoma (non-encapsulated)	5 cases
Mastitis (following lactation)	5 cases
Tuberculosis	1 case
Gumma	1 case

It should be noted that chronic cystic mastitis comprises over 47 per cent. of the benign group of breast lesions, adding to this the 5 cases of non-encapsulated papillary cyst adenomata which the writer believes properly belong to this group the percentage reaches 60.5 per cent.

The most frequently seen benign connective-tissue tumor, the intra-lobular fibromyxoma, peri- and intracanalicular forms, makes up 26 per cent. of our benign tumors. The remaining 13½ per cent. comprises the following:

	Per Cent.
Lactation mastitis	8
Tuberculosis	2¾
Gumma	2¾

The small encapsulated, smooth, firm, and hard adenofibroma has not been observed in this series.

While perhaps positive conclusions are not justified from the small number of cases here presented, the figures are at least suggestive and significant, and strongly point to a much keener conception on the part of the profession and the laity of the dangers of delay in seeking surgical relief. Competent advice is being sought earlier, malignancy is on the decline in breast lesions, and fewer radical operations are the result.

As it is manifestly impossible to cover in one paper the results

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of our studies of the different types of breast tumors observed, our further remarks will be confined to a consideration of those so-called precancerous, potentially cancerous, or borderline conditions of the breast that have been included here in the division of benign tumors. They form over 60 per cent. of our non-malignant cases.

It is of course recognized that each one of these lesions in the living subject possessed the potentialities for malignancy which make of them a most interesting group for surgical study.

But as Ewing states, "it should be emphasized that these diseases possess in themselves not a single essential element of the cancerous process."

MacCarty, in a recent careful study of 398 cases of carcinoma of the breast, found in every instance a coexisting mastitis. He agrees that the chronic mastitides do not necessarily mean eventual cancer, but contends that in every case of cancer will be found a chronic mastitis.

Billroth was the first to observe that cancer seemed never to arise in a normal breast.

For lack of a better term 18 of these regressive breast lesions have been classified as chronic cystic mastitis, the most commonly accepted term now used for this retrograde process, which embraces a macroscopic picture of fibrous and glandular hyper- or cytoplasia without encapsulation. Within the mass or masses are single or multiple cysts.

In a clinical sense the title of chronic cystic mastitis is somewhat a misnomer because clinical evidences of inflammation are absent, and histologically round-cell infiltration, dilated and distorted acini and ducts and fibrous and epithelial cytoplasia may readily be found in the opinion of the writer in any involuting breast. A proof that the term is not altogether exact or satisfactory is found in the many designations the lesion bears, such as fibrous or glandular hyperplasia with retention cysts (Whitney), abnormal involution (Warren), senile parenchymatous hypertrophy (Bloodgood), Schimmelbush's disease, Reclus disease and numerous other terms, none of which give a clear definition or understanding of the abnormal process or processes.

Different stages of this diseased condition of the breast give varying clinical gross pathologic and microscopic pictures which probably account for the numerous names given these interesting lesions. Two of the 18 cases of chronic cystic mastitis operated upon in this group were found in male breasts.

A general summary of our findings follows:

The ages of patients at time of operation ranged from twenty-one to sixty-eight years.

The ages of patients at first symptom of onset of disease varied from eleven years of age to sixty years.

The duration of the disease varied from one month to eleven years.

In 66 per cent. the symptom of onset was the finding of an irregular shaped mass or masses in the involved breast. In 30 per cent. pain and tenderness was the first symptom noted. In one case only was a discharge from the nipple seen. In one case a definite retraction of the nipple was observed.

In every case examined the skin was apparently normal. In no instance was absence or atrophy of subcutaneous fat noted. In two cases enlarged axillary glands were demonstrable.

Our investigations indicate that the lesions usually arise in and around the so-called nipple zone (15 cases). In two cases the mass was confined to the upper and outer quadrant and in one case the inner and lower.

Irregular masses single and multiple ranging in size from that of a pea to a hen's egg have been revealed upon palpation in 14 cases. The consistency of the lesions varied from moderately firm to hard nodular masses. In four cases no distinct tumors could be felt. Nine of the lesions occurred in the right and nine in the left breast.

In all cases the breast as a whole presented a degree of firmness not observed in the normal gland. Clinically no evidence of fixation or infiltration of structure was demonstrable in 16 of the 18 cases. As previously stated, in one case retraction of the nipple was noted. Seventeen of the cases operated upon exhibited abnormal-increase of both fibrous and parenchymatous structure. In seven cases a marked diffuse fibrosis was the prominent pathologic picture. In two cases a greatly increased parenchymatous hyperplasia existed. In one breast (male) the glandular elements were negligible, a practically fibrous (non-encapsulated) mass forming the lesion. In eight of the cases macroscopic cysts, single and multiple, were present. On section the cysts were seen to vary in size from a bird shot to a pigeon's egg. The cystic contents generally were fluid, albuminous, turbid, or clear, straw-grayish and brownish in color.

In practically all the lesions microscopic fields revealed numerous areas showing dilatation and distortion of the ducts and acini cytoplasmia and round-cell infiltration.

Operations.—In 14 cases the entire gland has been removed. In none of these cases was there noted any abnormal condition of skin, or nipple, subcutaneous fat, infiltration or fixation in any direction, or axillary gland involvement.

In 2 cases the gross pathologic appearing areas only have been

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removed, and in 2 cases so-called complete operations (including removal of axillary glands and fat and pectoral muscles) were performed, because of the suspicion clinically of malignancy.

In one instance there was apparent enlargement on palpation of axillary glands, and in the other definite retraction of the nipple and enlarged axillary glands.

In all of the lesions the microscopic pictures were negative for invasive or migratory cytoplasia.

The question arises, is it possible by our present methods of examination of this type lesion, to determine definitely and positively that no microscopic area or areas of adenocarcinoma are present or exist, when no gross picture of even suspicious tissue can be identified, or when dozens of frozen or imbedded sections prove negative upon microscopic study.

It is the opinion of the writer that microscopic areas giving the picture of malignancy probably exist without detection in many of these lesions, even when most painstaking study and search have given negative findings. If such is the case, how great a value may be placed on a negative microscopic finding?

The other phase of the question is how much value should be placed upon the microscopic picture alone, of a small isolated area of apparent adenocarcinomatous change, when the microscopically malignant mass is situated well within the boundaries of the mammary gland (even though it shows active cellular mitosis) and gives no clinical or gross pathologic evidence of its presence.

The writer is firmly of the opinion that the proper interpretation of the clinical operative and gross pathologic pictures these lesions present must be the guides and factors that decide the type of operation necessary to be performed in any given case. The microscopic discovery of a localized area only (without macroscopic appearance of any degenerative process) should not be the factor in deciding upon a so-called radical or complete breast operation for cancer.

The non-infiltrated, encapsulated, freely movable tumor, in the mammary gland, where skin, fat, capsule axillary glands, nipple, etc., are not infiltrated, requires only surgical removal of the tumor with its capsule. In chronic cystic mastitis the real boundary zone of the lesion is the gland itself, until such time as the regressive changes that here occur are established, or disposed of, as being precancerous in their nature, the operation for the removal of the entire gland, with nipple and areolar tissue, should be advocated.

On the other hand, it does not seem justifiable to perform the so-called radical or complete breast operation in the absence of definite clinical or gross pathologic signs of infiltration or degeneration even

where the microscopic field shows a localized area of epithelioma cellular invasion or migration into the stroma, so long as the malignant microscopic area is well within the boundary zone of the gland.

Accepting Sampson Handley's theory that carcinoma spreads by permeation (and until the larger lymphatic trunks are reached this seems to be true), ablation of the breast alone would seem to be sufficiently radical where our clinical operative and gross pathologic criteria, after careful study, fail to exhibit any factors we regard as cancerous. In other words, the discovery of a microscopic area of cancer should not be the signal demanding the most radical operation on the breast.

The 5 cases grouped under the designation papillary cystadenoma give clinical pictures resembling those of chronic cystic mastitis. They comprise non-encapsulated masses which exhibit in the gross and microscopic pictures cysts with intracystic papillomatous ingrowths imbedded in areas of more or less diffuse fibrosis, glandular hyperplasia and round-cell infiltration.

These lesions apparently belong to a mature and perhaps active stage of chronic cystic mastitis. One of the patients in this group exhibited masses in both breasts, the clinical picture being as follows:

Patient forty-five years of age; duration of tumors in both breasts one month; no increase in size of tumors since first observed. Symptom of onset in left breast, pain, prickling and dragging; symptom of onset in right breast, discovery of tumor. No discharge from nipples. Youngest child fifteen years old. No lactation mastitis, menstruation normal. Both breasts moderate in size; skin, subcutaneous fat and nipples normal. No axillary glandular involvement. Small, firm, freely movable nodule size of a marble felt in right breast just below nipple. In left breast is felt a rounded, freely movable mass in the nipple zone, the size of an English walnut.

The gross pathology in the larger mass in this case gave a picture of numerous cysts of varying size containing clear fluid, the cysts being imbedded in a firm fibrous stroma. The papillomatous ingrowths were observed in the microscopic fields only.

In only one of the five cases was there definite large macroscopic papillomata within the cyst walls. The other three lesions presented nothing worthy of further report.

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SPONDYLITIS DEFORMANS RELIEVED BY ALBEE OPERATION

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OF all the ills that man is heir to, none can claim priority over spondylitis deformans as a deforming and disabling disease, not only because of its chronic progressive nature, but also because of our inability either to check its progress or to relieve its distressing symptoms. A fully developed case once seen is not soon forgotten. It presents a most hideous spectacle. If one can conceive of a spine in which there has been a deposit of bone along the bodies of the vertebrae causing lipping of the margins, absorption of the intervertebral discs, marked kyphosis and ankylosis, and, as is frequently the case, pressure on the nerve-roots due to deposits around the intervertebral foramina, and if other joints are similarly affected, he will surely admit the accuracy of the introductory statement.

The appearance of these patients is quite characteristic. On standing, they present marked kyphosis of the spine which is as rigid and unyielding as a board, resulting in forward slope of the neck with the face looking downward. On attempting to look up, the pelvis is tilted backward and the knees flexed. On walking, they seem on the verge of toppling forward with each step. On lying supine, only a portion of the spine is in contact with the couch, the head, neck and shoulders being unsupported. On assuming a prone position, only the head and knees are in contact with the couch, the spine and thighs forming an arch. Fortunately, not all cases attain such a degree of severity.

AUTHOR'S CASE.—W. A., male, aged forty-four years, residing in Brooklyn, New York; occupation, plumber. He had never been previously ill with the exception of measles at the age of nine years, from which he recovered without complications. Twenty-eight years ago, while carrying a heavy weight (metal pipe), his back suddenly gave way, and doubled up like a jack-knife. For the following week, he was troubled with pains and stiffness of the back, but continued working. In the course of several years, noticed a protrusion of the spine in the dorsal region, round shoulders developed and some pain was always present but not sufficient to interfere with his work. It was in 1909, or twenty-two years after the above injury, that working became a hardship and from time to time he had to lay off.

In 1910, he came to the Dispensary of the Hospital for Deformities and Joint Diseases¹ for treatment. Examination showed that he was round-shouldered, his back kyphotic over the mid-dorsal region, stiff and painful on attempting any motion; scapula winged, chest emphysematous; his neck was bent forward, face looking downward, and he walked with a slow and careful gait, leaning forward slightly. In the lumbar region, movements were normal, but his upper back was rigid and tender. The X-ray showed an absorption of the mid-dorsal fibrocartilages with the vertebræ wedged. There was an outgrowth of bone with lipping of the margins of the sixth to ninth dorsal vertebræ on both sides of the median line. Blood, urine and sputum were negative. Temperature was normal.

A plaster jacket was applied to be worn continuously. Tonics were prescribed. Although the pains were somewhat relieved, the patient was very uncomfortable in his jacket, was unable to work, and breathing, being abdominal, was interfered with.

In 1915, he reported at the hospital in a very depressed state of mind, because the disease was progressing; the jacket no longer gave any relief, and he was on the verge of pauperism owing to inability to work at his trade. He urged that something radical be done. An Albee operation was advised, but very little encouragement given as to the ultimate benefit to be derived, excepting that it might support the spine without the aid of a brace or jacket and would permit abdominal breathing.

On April 8, 1915, the operation was performed in the usual manner. A groove was made in the spinous processes from the fifth to the tenth dorsal vertebræ, and a graft from the tibia inserted. With the exception of a slight temperature lasting three days, he made an uneventful recovery. A jacket was applied on May 6; on May 10, the patient was allowed up, and on June 15, was discharged from the hospital.

During August, 1915, he discarded the plaster jacket and began to work in an ammunition factory. I have seen him once every three months since. He is absolutely free from pain, and there is very little restriction of motion in spite of the fact that his work is very laborious, consisting of carrying shells weighing up to 50 pounds. He has not lost a day during the past year.

So favorable a result was entirely unexpected. I had anticipated some benefit from the operation, but not complete relief. The only explanation I can offer is that as a result of inserting a graft into the spine, sufficient bony ankylosis occurred to give support to the spine and permit complete physiological rest to the diseased area; nature

¹ From the Service of Dr. Henry W. Frauenthal.

ALBEE OPERATION IN SPONDYLITIS DEFORMANS

under such favorable circumstances completing the cure. This was also a favorable case because the diseased area was limited to several vertebræ.

This is the first time to my knowledge that the Albee operation was attempted for spondylitis deformans, and in view of the result obtained, I believe it has a distinct indication in (1) those cases where the disease is localized, (2) in the early stages before the disease has progressed, (3) where there is an acute exacerbation on a chronic process, (4) where there is abdominal breathing which is interfered with by spinal brace or plaster cast, (5) as a last resort in those hopeless cases where all other methods have been tried and found wanting.

FELONS

BY GEORGE M. DORRANCE, M.D.

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It is a curious fact that in every walk of life the majority of us strive to do the big things with the result that some of the simpler, obvious, everyday things are treated lightly or totally ignored. Surgery is no exception to the rule. The youngest member of the profession seeks to invent some new methods of devising or improving major operations, thus neglecting the common ills with which he daily comes in contact. In every surgical dispensary and in the offices of many practitioners scarcely a week goes by that a patient suffering from a felon does not apply for treatment. In the vast majority of cases, he is told that the condition is not serious; some poultice or local application is made at the first visit and later, when suppuration occurs, it is lanced. This form of treatment often results in the loss of a part or all of the distal phalanx.

In the *Journal of the American Medical Association* for May, 1913, I published an article on the "Anatomy, Pathology and Treatment of Felons." This was the result of several months labor in the dissecting room, pathological laboratory and surgical dispensaries. At that time I gave the following definition, "A felon is the primary inflammation of the connective-tissue space which is situated on the palmar surface of the last phalanx of the fingers." This definition was determined only after a careful study of the anatomy of the finger and careful dissections of several felons. Wax was injected into the fingers, and frozen sections were made which clearly demonstrated the presence of this connective-tissue space.

Kanavel in his admirable work on infections of the hand did considerable work on the anatomy of the finger and, following out his plan, we had several sections made of the different parts of the finger. A study of these will show this space clearly and a knowledge of this will explain to a large extent the pathology of felons and suggest a logical treatment.

We also made some X-ray studies of the finger after injecting red lead into this connective tissue. Kanavel had already pointed out that the epiphysis of the distal phalanx was supplied by a branch of the digital artery before it enters this connective-tissue space. This I found to be true in most of my dissections. The diaphysis, however, not only

FELONS

receives its blood supply from a different branch, but it is supplied only after the artery has passed into this connective-tissue space.

Now when we have inflammatory processes going on in this space with the subsequent swelling, the venous return is shut off, hence that peculiar throbbing pain so characteristic of felons, due, of course, to the pressure on the nerves with each pulsation of the artery; the pressure continuing, the arteries are compressed, thus shutting off the blood supply and necrosis ensues. The source of the infection is invariably a puncture wound, needle or pin prick, hence felons are more common in women.

Symptoms.—As a rule the first intimation the patient has of the trouble is a consciousness of a sticking pain in the tip of the finger, often describing it as if he felt a foreign body in there, *e.g.*, a splinter. Within a few hours, this gives way to the throbbing pain. Then the distal portion of the finger becomes red, swollen and tender. At the end of about twenty-four to thirty-six hours, fluctuation is present and all pain ceases. This symptom of relief is often misleading to both the patient and the physician, for instead of being a favorable condition, as they suppose, it means that gangrene and possibly necrosis are beginning.

Treatment.—An incision starting at the base of the nail on one side is extended in the line of the furrow over the tip of the finger, down on the other side to a point on a level with the beginning of the incision, in that way, making a flap of the tip of the finger.

The appearance after the flap is made and for the first forty-eight hours is often the source of worry to the patient and the operator. This is the critical stage in the treatment and on no account should the drainage be removed and the flaps returned to their original position. The final result will not be a deformity and bear this in mind. We grant that for a week or ten days afterwards you might regret your radical procedure, but experience has shown that if the method given above is carefully adhered to, the final scar will be scarcely noticeable.

The wound is dressed with normal saline solution. The dressings are removed daily, but the drainage is undisturbed until the third day, when it is permanently removed.

Keeping the parts moist by soaking the finger (dressing left intact) every third hour in normal saline solution is a source of comfort to the patient and aids drainage.

It is now practically three years since I advocated this method and have had the privilege of seeing many cases so treated by myself and others. The most common mistake made is not getting the incision close enough to the nail. This is absolutely essential to preserve sensa-

GEORGE M. DORRANCE

tion in the tip of the finger. Next in order comes the poor result from waiting too long. To be successful, it must be done early. Another bad incision is the longitudinal, which fails to give proper drainage.

I have 47 cases on file since my last paper, followed from beginning to end. Of these, 40 cases were opened within the first forty-eight hours, and complete cure ensued. Of the other 7, 5 were done after fifty hours had elapsed. Of the first two series the results were better than I have seen from longitudinal incision, and of the last two cases, one had to have the phalanx removed while the other recovered only after a long and tedious treatment with a deformed finger.

It can be dogmatically asserted that if the procedure is followed out properly, observing the rules, loss of sensation in the tip of the finger never occurs and the final result will be practically a normal finger.

CONCLUSIONS AND RULES

1. All cases are caused by puncture wounds.
2. Cases must be treated within forty-eight hours to get a perfect result.
3. Cases of over seventy-two hours' standing have usually damaged the bone.
4. Nitrous oxide anæsthesia is advisable in the majority of cases.
5. The length of time required for perfect function depends upon the time elapsing before treatment is instituted.
6. Restoration of function is quicker by this method than any other tried in my experience.

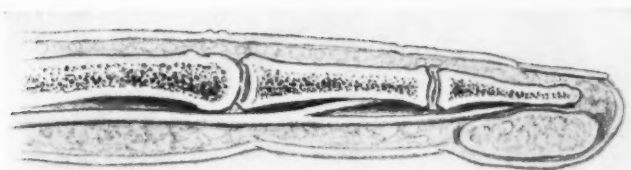


FIG. 1.—Note the fact that this distended space is walled off from the remaining subcutaneous tissue of the rest of the finger.

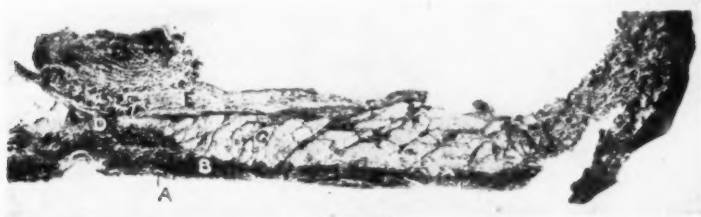


FIG. 2.—Longitudinal section of distal phalanx of index finger. The bone was carefully dissected out before fixation so that decalcification was unnecessary. A, epiderm; B, dense fibrous corium; C, loose areolar fatty and connective-tissue space in its entirety, condensed fibrous tissue limiting the space at E, tendon of flexor longus digitorum.



FIG. 3.—Low power of the area B of Fig. 2. A, epiderm; B, dense corium; C, loose space; D, limiting fibrous portion of space; E, tendon of flexor longus digitorum.

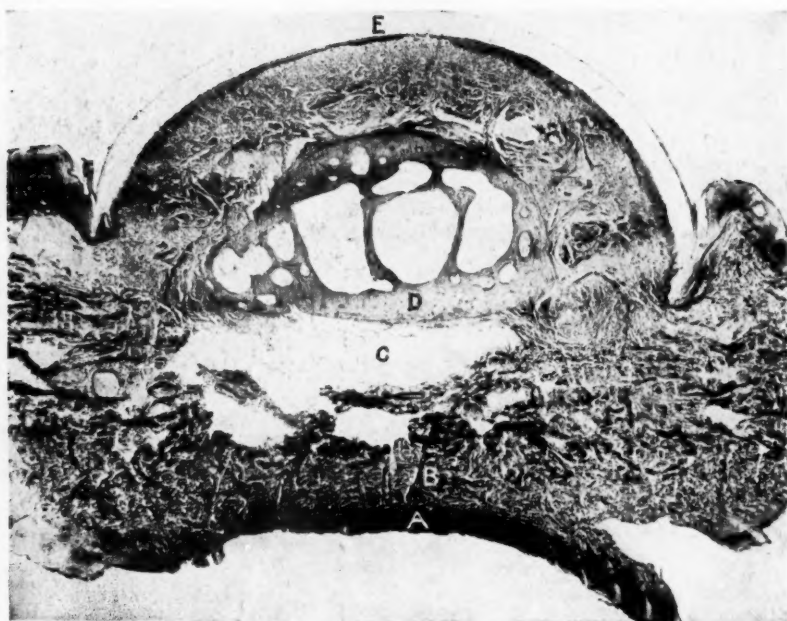


FIG. 4.—Transverse section of the digital phalanx. Section made after decalcification. *A*, epiderm; *B*, dense corium; *C*, loose areolar fatty and connective-tissue space, some of which is lost in section; *D*, bone; *E*, nail-bed.



FIG. 5.—Connective-tissue space injected with red lead.

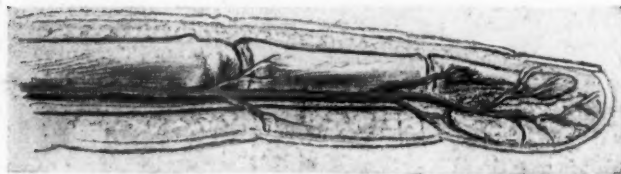


FIG. 6.—Note the fact that the diaphysis receives its blood supply only after the artery has passed through this connective-tissue space. In order to bring this point out more clearly we injected a mixture of red lead and turpentine into the radial and ulnar arteries of a cadaver and had X-ray pictures made.



FIG. 7.—Blood-vessels. Note how clearly this point is brought out in the X-ray plate



FIG. 8.—Proper incision.



FIG. 9.—Flaps with drainage.



FIG. 10.—Note position of wrong incision which injures nerve supply to flap.



FIG. 11.—Nerve supply of finger.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting, held October 11, 1916

The President, DR. CHAS. N. DOWD, in the Chair

TOTAL EXTIRPATION OF PENIS FOR CARCINOMA

DR. HERMANN FISCHER presented a man, sixty-three years of age, who was admitted to the German Hospital with nodular hard tumor, involving the glans penis. It was the size of a peach and had grown into the prepuce, so that the latter could not be retracted. There was quite a profuse discharge of ill-smelling pus from the preputial sac. In both inguinal regions there were large metastatic tumors, the glandular mass on the left side being as large as a man's fist and seemingly tightly attached to the sheath of femoral vessels.

As the man was very anæmic and not a very good surgical risk, the metastatic glandular tumors were first removed, and two weeks later the total extirpation of the penis was done. The incision circled around the root of the penis and divided the scrotum in the median raphé down to the perineum. The penis was then dissected from its attachments, including the crura; the pendulous portion of the urethra was removed in its entirety, being divided close behind the bulb, on account of metastatic carcinomatous nodules that had developed in the posterior portions of the corpora cavernosa penis and had encroached upon the posterior part of the pendulous portion of the urethra. After division of the urethra, its membranous portion was sutured to the skin in the perineum. The man made a good recovery. His bladder function is normal. The operation was done six weeks ago. This case was here shown because it is rarely necessary to sacrifice the whole pendulous portion of the urethra. The chances of getting a necrosis of the thin membranous portion with subsequent development of a stricture are therefore greater. In fact this undesired accident happened in an identical case, upon which he operated two years ago. The patient has to bougie himself once a week to keep the urethral opening patent.

DR. WILLY MEYER said that in such cases the decision is to be made whether to amputate the penis or simply extirpate the growth. He

preferred amputation after Bardenheuer's method in which is left a stump of the urethra with its corpus cavernosum right in front of the scrotum, projecting beyond the amputation line, for about one-half inch. This portion of the stump of the urethra unfolds itself, so to speak, and projects like a prolapse. There remains a wide opening of the urethra through which the patient urinates straight forward.

If there is further involvement, he would always divide the scrotum and extirpate the penis totally, which is not a difficult operation.

The point is to leave the corpora cavernosa as much as possible; the stump is then transplanted into the perineum in front of the anus. And there it is better to split the urethra posteriorly, making a slight hypospadias. Regarding the extirpation itself, it is best to primarily ligate the two dorsal arteries, with their veins, and to ligate also the two profundæ; then amputate the corpora cavernosa as near to the pelvic bone as possible, but always putting a retention suture through the septum first. In one case where he omitted that, the remnants of the corpora slipped back, and he had a good deal of trouble in pulling them sufficiently forward again to stop the hemorrhage. But if this is done and they are secured properly, one can in almost every case stitch the tunica albuginea of the one side to that of the opposite side, and in this way get primary union.

The principal point, however, is the involvement of the inguinal glands. In the majority of cases where recurrence occurs, it will rarely be found in the portions of the corpora cavernosa left behind, but in the inguinal glands. So the question, how far they are involved, will principally determine the final result.

PROSTATIC TUBERCULOSIS: ASCENDING RENAL TUBERCULOSIS

DR. EDWIN BEER presented a male, seventeen years old, who since four months has had pain at the end of the penis, marked frequency, and has passed clots. The blood was never mixed with the urine; it was either at the beginning of the stream or terminal. About two months before admission he had had pain in right lumbar region, and two weeks before admission similar pains in left lumbar region. Of late, just prior to admission frequency was half hourly. Examination showed slight right lumbar tenderness, kidney not palpable. By rectum prostate was small, the left lobe was atrophic, while the right lobe was practically normal. The urine contained many pus and red cells, a few tubercle bacilli, and was turbid. After gentle massage of the evidently tuberculous prostate, the urine was loaded with expressed tubercle bacilli.

PROSTATIC TUBERCULOSIS

April 15, 1916: Cystoscopy showed a moderately inflamed bladder. The right ureteral meatus was wide open and admitted a catheter into the right pelvis. By introducing into the bladder some coloring matter, it was possible to recover same from the right pelvis, demonstrating that catheterized right kidney specimens were contaminated from the bladder and that such specimens would be of no conclusive value in determining whether the right kidney was tuberculous or not. On the left side no catheter could be introduced. Indigo carmine excretion from both sides was in diminished concentration but about equal. These findings were confirmed by re-examination. As it was impossible to decide by cystoscopy and ureter catheterization whether one or both kidneys were also involved in addition to the prostate, and as the wide-open right ureter might have been the result of back pressure from the very irritable bladder, as well as from a ureteral tuberculosis, it was thought that it might be possible to reach a conclusion by filling the bladder and taking pyelograms with argyrol in the Trendelenburg position. Much to our surprise the argyrol ascended both ureters, the left which could not be catheterized as well as the patulous right one. The right pelvis appeared deformed and its calices were dilated. The fact that both ureters allowed the ascent was very suggestive of the fact that we were dealing with a symmetrical process due to back pressure.

Old tuberculin injections were then resorted to to assist in clearing up the situation. Graduated doses were used up to 4 mgms. after determining the patient's susceptibility to the Pirquet skin reaction, which was positive. Under this the frequency became more marked, and the left atrophic half of the prostate became very tender. The temperature rose to 101, pain developed in the right lumbar region and this region became tender on palpation. After the last injection of 4 mgms. slight pains developed in the left lumbar region also. As these results were not conclusive, because they proved only that the left half of the prostate was tuberculous and did not definitely decide whether one or both kidneys were involved, the local pains and tenderness being possibly due to back pressure caused by the tuberculin irritation at the neck of the bladder and the associated increased frequency, which now was every fifteen to twenty minutes, it was decided to explore both kidneys and ureters, and to remove that side which was involved, provided the other was normal, and leave the prostate to take care of itself under hygienic measures.

May 13, 1916: The left kidney and ureter were exposed. The kidney was found to be normal and the ureter was found to be slightly dilated but of normal consistency and in no wise inflamed. This wound

was then closed. Then the right kidney was exposed. This was found to be enlarged and distended, and its ureter was markedly thickened as in the typical tuberculosis cases. A complete uretero-nephrectomy was then performed, by tying the vascular pedicle and freeing the ureter still attached to the kidney as far down as the lumbar wound permitted. After tying a traction ligature on this ureter at its lowest freed level, the kidney was replaced, and a second pelvic pararectus incision was made, exposing the pelvic ureter which was easily identified by traction upon the above traction ligature. The ureter was then cut off with cautery close to the bladder after ligation of the vesical end. Then by means of the traction ligature the whole ureter and its kidney were extracted from the lumbar wound without any contamination of the wounds. The wounds were closed in the usual way and the patient made an uneventful recovery.

The specimen presented showed a most beautiful ascending tuberculous process, with most involvement at the lower end getting less and less as the kidney was reached.

The patient who was not much more than skin and bones at the time of the operation, improved surprisingly in health and gained much weight. The frequency became much less, and the patient was discharged with both wounds closed, no infection of the wounds having taken place. His prostate was treated for a time with deep X-ray therapy. In September, the patient returned stating that he was passing some urine from his right rectus wound and during the past weeks they have been trying to close this leak by using an indwelling catheter. It looks as if this might prove successful.

This case is presented with these numerous facts because of the rarity of operative interference in ascending renal and ureteral tuberculosis, and to show how difficult it is to diagnosticate renal involvement when a tuberculous prostate is pouring tubercle bacilli into the urinary stream. Under such circumstances contamination of the kidney specimens is so likely to occur that the guinea pig test almost regularly will be positive on the kidney specimens, and at times the contamination may be so gross that the slide examination may be positive due to contaminations in transit from the cystoscopic sheath through the carefully washed bladder into the ureters.

BILATERAL NEPHROLITHIASIS¹

DR. EDWIN BEER presented a woman who had been the subject of bilateral nephrolithiasis. A right nephrectomy was done for calculous pyonephrosis, and a left nephrotomy and partial decapsulation for

¹ Case recorded in part, *ANNALS OF SURGERY*, October, 1916, p. 456.

BILATERAL NEPHROLITHIASIS

stone. A second nephrolithotomy and decapsulation for stone recurrence was performed. Then a tertiary nephrotomy and decapsulation, with permanent kidney drainage.

She was first admitted to Dr. Gerster's service in Mt. Sinai Hospital in 1912, and in October and November a two-stage nephrectomy for right calculous pyonephrosis was performed. At that time the patient's X-rays showed the stones in the right kidney—two stones in the right kidney; in the other kidney apparently as yet no deposit.

The patient was readmitted to the hospital in 1914; and at that time in her left kidney, just below the rib, there was a very distinct shadow, with all the symptoms of nephrolithiasis. She developed an anuria, with pyelonephritis. The anuria was relieved by passing a ureteral catheter. The temperature continued around 105° and 106°, so that on September 18, 1914, a decapsulation was done, together with a nephrolithotomy with drainage. The patient made a satisfactory recovery, and the wound healed. There were repeated attacks of pyelonephritis during the subsequent months, and the stones reformed. As the subsequent stones reformed, they formed casts of this kidney and pelvis. During this period the patient was carefully studied, both with the object of controlling stone formation, and with the object of determining her renal capacity. From the time of that operation—September, 1914—until June 5, 1915, when they were compelled to reopen that kidney, repeated tests of kidney functions showed a gradual diminution in output of phthalein, as well as of indigo-carmin (for test results see page 456, *ANNALS OF SURGERY*, lxiv). On June 5, 1915, during another attack of fulminating pyelonephritis, with high temperatures, a second nephrolithotomy and decapsulation was performed. Prior to that operation, the patient evidenced all of the signs of renal insufficiency—continuous vomiting, high blood urea nitrogen and incoagulable nitrogen, and markedly diminished in output tests. This operation was done under spinal anæsthesia, so as not to affect the remaining parenchyma of the kidney; and the patient made a satisfactory recovery, without developing uræmia.

After that operation, he determined to keep a permanent tube as a safety valve in the kidney, so that in case new stones tended to form, they might be washed out in an embryonic state—as well as to control the infection. Unfortunately, the tube was allowed to come out and was not replaced, after having been in place about two months. Then the patient, with the sinus closed, developed again anuria, which was relieved by ureteral catheterization, catheter passing by the stone and entering the pelvis. Since March, 1916, she is wearing a catheter in

her left kidney; and during this time the kidney pelvis and ureter have been regularly washed into the bladder, providing thus a double outlet. Now, no stagnation can take place, and it seems as if it was possible to control in this way the development of acute pyelonephritis, since, by avoiding all damming back against the kidney and all stagnation in the pelvis, it looks as if infection of the parenchyma were controlled.

Under this therapy the patient has gained some fifteen pounds; she has improved markedly in general health, and the resuscitated solitary kidney has increased the phthalein output to 37 per cent. A recent X-ray which was taken about a month ago shows that despite this permanent drainage there seem to be two small deposits in the kidney, probably renal calculi, although they may be calcification along the drainage tract. Those shadows are altogether different from shadows which had developed in the same period of time after the second and after the first nephrotomy and drainage. These stones, as far as symptoms are concerned, seem quite harmless as long as the secondary pyelonephritis is prevented by permanent drainage.

FRACTURE OF LOWER ARTICULAR SURFACE OF HUMERUS

DR. WILLIAM DARRACH presented a woman sixty years of age who on February 2, 1916, fell on the ice. She apparently had her elbow flexed at right angles with her forearm across her abdomen and struck directly over her elbow. Three days later she came to the Presbyterian Hospital for treatment. At that time the left elbow was greatly swollen, with marked ecchymosis. A lateral X-ray plate showed the presence of a fragment with a semicircular outline lying above the coronoid and in front of the lower humerus (Fig. 1). The anteroposterior view showed the same fragment to be just above the region of the trochlea. The lower margin of the articular surface seemed normal in outline except for the absence of the external trochlear ridge. There was a line of fracture to be seen above the capitellum.

Five days after the injury under 1 per cent. novocaine an antero-external incision 12 cm. in length was made along the inner margin of the brachio-radialis and deepened through the deep fascia. The muscle was retracted outward exposing the musculospiral nerve. The brachialis anticus was split 1 cm. to the inner side of the nerve and the capsule opened vertically down to the tip of the coronoid process. The line of fracture separating the capitellum could be made out but there was almost no displacement of the fragment. The loose fragment was found to be completely separated from all its attachments. It was rotated around and an attempt made to force it back into position. This

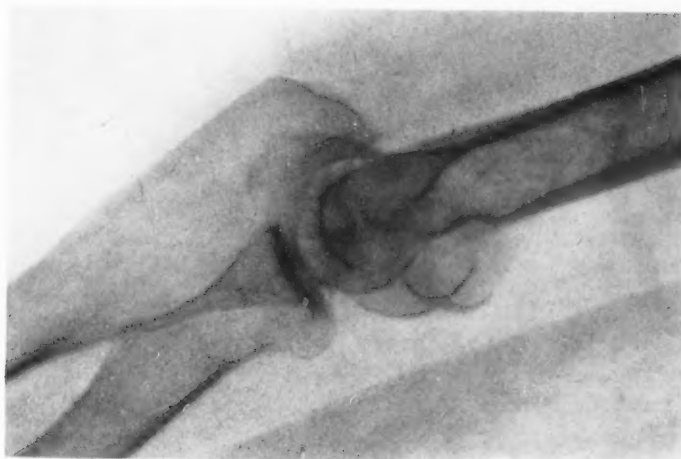
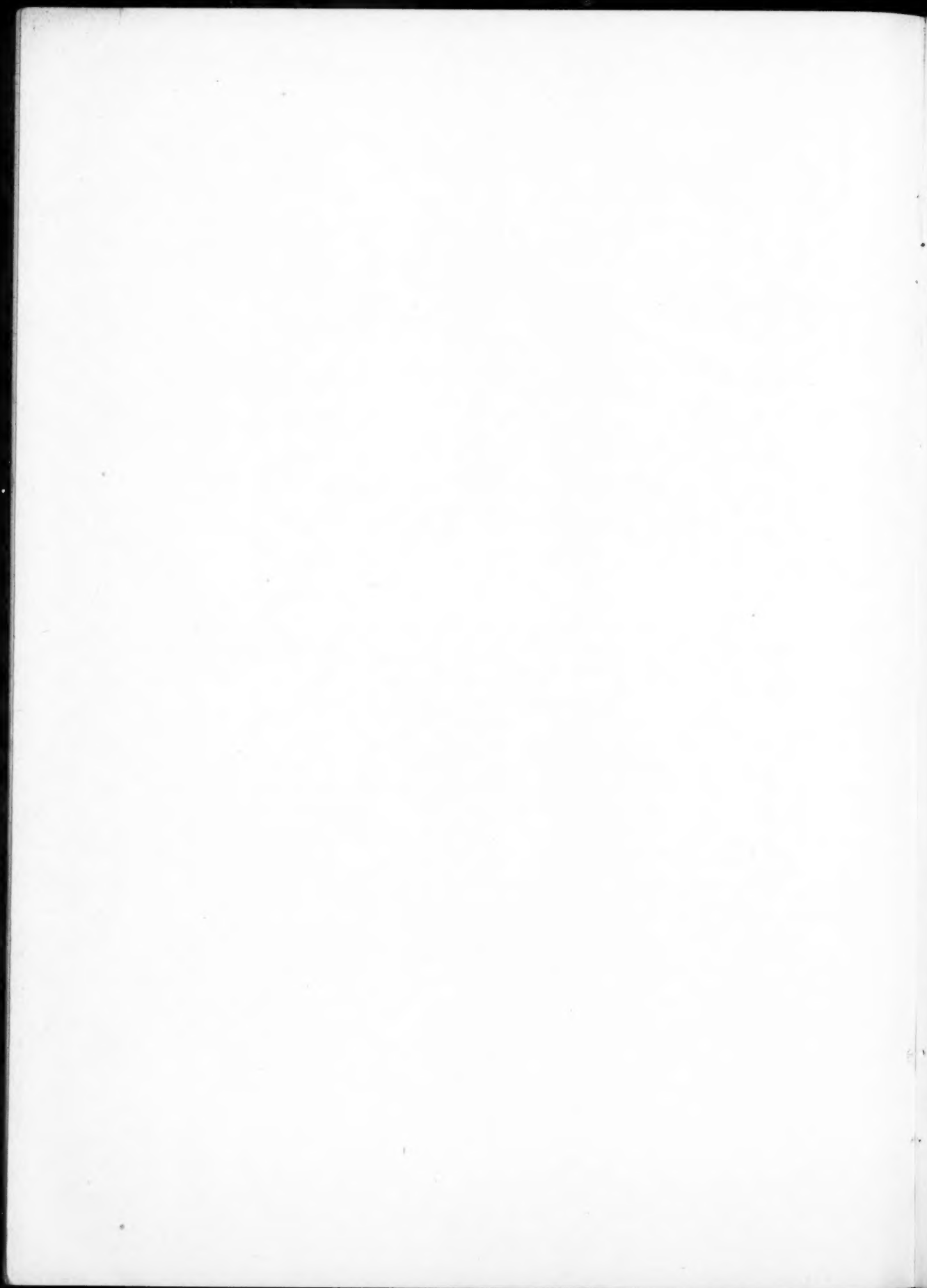


FIG. 1.



FIG. 2.



PAGET'S DISEASE OF THE NIPPLE

was so painful that she was given nitrous oxide and a second attempt made, which was unsuccessful. The fragment was then removed. Flexion was immediately possible to 45° and extension to 170° . The brachialis anticus was sutured with plain catgut as was the deep fascia. Skin was closed with silk and the elbow bandaged at 90° . The nitrous oxide was stopped as soon as the fragment was removed. The fragment consisted of the anterior two-thirds of the whole trochlea (Fig. 2), the line of fracture being almost vertical.

The wound healed primarily and motions and massage were begun after ten days and kept up for fourteen weeks.

On April 4, she had flexion to 80° and extension to 140° . On October 5, 1916, she could flex to 75° and extend to 150° , there was four-fifths the normal amount of pronation and three-quarters of supination. There was a little gritting sensation, without pain, on flexion and extension. She can reach the back of her neck, the back of her waist band and can arrange her hair.

The case is reported because of the rarity of fracture of the trochlear surface and because the greater part of the operation could be done under local anæsthesia.

OPERATIVE TREATMENT OF INTESTINAL OBSTRUCTION

DR. CHAS N. DOWD read a paper with the above title.

Stated Meeting, October 25, 1916

The President, DR. CHAS. N. DOWD, in the Chair

PAGET'S DISEASE OF THE NIPPLE

DR. WALTON MARTIN presented a woman, sixty-one years old, whom he had first seen three years ago. She was referred to him for an erosion of the nipple of the left breast. There was a small area on the side of the nipple, sharply defined covered with a crust. From time to time the crust would fall off leaving a raw surface with a viscid exudation. The condition had been present for several months. On examination of the breast no tumor was palpable, although the patient said that since the birth of her child, 30 years ago, she had noticed a small lump behind the nipple.

The nipple, underlying fat and an elliptical area of skin were removed. Microscopical examination of the eroded area on the nipple showed simple inflammatory changes. There was no evidence of carcinoma of the underlying tissue, nor of epithelioma of the skin.

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About two years later the woman returned with a hard irregular mass in the breast beneath the scar of the excised area. There were enlarged glands in the axilla. The breast, cellular tissue, lymphatics of the axilla and the pectoral muscles were removed. The woman made an uneventful recovery, the wound healed by primary union. Macroscopical examination showed a tumor 2.5 cm. by 5.5 cm. in the breast tissue.

Microscopical examination showed the typical structure of a scirrhous carcinoma. The lymph-nodes were invaded by the neoplasm.

Dr. Martin said he showed the patient, as she presented the sequence of lesions referred to by Sir James Paget in a paper published in 1874, under the title of Disease of the Mammary Areola Preceding Cancer of the Mammary Gland. Paget had noticed fifteen instances in which, in women between forty and sixty, there had been an eruption on the nipple or areola, looking like eczema excepting that in the majority of instances it was more intensely red, which showed no tendency to heal, and which in every instance that he had watched was followed by cancer of the mammary gland within two years.

Since then much has been written on the subject. But more emphasis has been laid on the character of the skin lesion than on the curious sequence of events observed by Paget. Handley, however, offered a rational explanation. The chronic eczema of the nipple is merely a secondary manifestation of impaired lymphatic return from the skin of the areolar district, produced by a scirrhous carcinoma too small to be palpable.

In any event a middle-aged woman with a unilateral chronic intractable eczema of the nipple, should be frequently examined, at least every month. Had he, he said, done so in this instance he might have detected this tumor when it was much smaller, and possibly before the involvement of the axillary nodes.

PRIMARY MELANOSARCOMA OF THE RETRO-ORBITAL TISSUE

DR. HERMANN FISCHER presented a woman, aged thirty-eight years, who was admitted to the hospital September 18, 1916.

About nine months before patient noticed that her left eye became swollen and that she had double vision, with impairment of vision of the left eye. She never had much pain, except for spasmodic sharp pains which occasionally shot across her forehead. The swelling and bulging of her left eye had continued to get worse and vision had become worse. Pain had not increased to any appreciable extent.

Examination of patient showed the following condition: The right eye was normal to all appearances. There was a marked exophthalmus

MELANOSARCOMA OF THE RETRO-ORBITAL TISSUE

of the left eyeball. The movements of the eyeball, however, were not impaired. Pupils react to light and accommodation. Ophthalmic examination shows a choked disk, no other abnormalities. No signs of intra-ocular tumor formation. Vision on left side: Finger counting at one meter. Wassermann reaction negative. All other organs of the body without anomaly. Diagnosis: Retro-orbital tumor. It was planned to extirpate the tumor with preservation of the eyeball, if the growth proved to be benign. A Kroenlein operation was done. After retracting the orbital bone-flap a pigmented lobulated soft tumor protruded which occupied the orbital tissue posteriorly and to the outer side of the bulbus. It had extended into the temporal fossa where some coal-black streaks of pigment could be seen infiltrating the temporal muscles. There were, however, no tumor masses involving the muscular fibres. It looked more as though some black powder had been sprinkled upon the tissues. The whole tumor could be shelled out from the orbit with comparative ease. It had the size of a plum. After removal of this mass it was noticed that another small growth was closely attached to the episcleral tissue but had not pierced it. This tumor surrounded the optic nerve and had grown through the optic foramen along the sheath of the nerve towards the anterior cerebral groove. With a small Volkmann's spoon he entered the optic foramen and removed all of the pigment masses that he could reach. As there was no doubt about the malignancy of the tumor he decided upon the complete clearing out of the orbit, leaving nothing but the bony wall. The ciliary margins of the eyelids were then extirpated and the eyelids sewn together and used as a skin-flap to cover the orbit. The bone-flap was put back and a gauze drain inserted into the depth of the orbit.

The first two days after operation the patient was fairly comfortable. On the third day the patient complained of a headache. At 4 P.M. of the same day the temperature rose to 102.2. In spite of the rise in temperature the patient had been fairly comfortable when at 1.30 A.M. she suddenly fell into convulsions, with contractions of right side more marked than on the left. She had seven convulsions without once regaining consciousness. The next day patient felt much better, she had no headache and did not vomit. Temperature at 8 P.M. was 102.4. That night (fifth day after operation) she slept well. Toward morning stiffness of neck and pain were complained of. There was a moderate foot clonus and a positive Kernig on both sides and a moderate rigidity of both arms. Lumbar puncture showed 20 c.c. of yellowish, slightly turbid fluid. Examination of this fluid showed 114 cells and globular 2+, also *Staphylococcus albus*.

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Wassermann reaction of spinal fluid was negative. After a few days all these symptoms improved and on the eighth day after operation, patient felt fairly well.

On microscopic examination the tumor proved to be a spindle-celled melanosaarcoma. The tissues of the bulbous were free from the tumor.

Dr. Fischer remarked that primary retrobulbar tumors of the orbit are not very frequent and the pigmented type of the sarcoma is very rare indeed. Of 100,000 cases of eye diseases treated at the New York Eye and Ear Infirmary from 1897 to 1900 there were but twenty-four cases of primary orbital tumors. Schaaf found among 40,415 patients at the Giessen Klinik during twelve years only twelve primary tumors. The melanosaarcomata of the orbital tissue start almost invariably from the tractus uvealis, and are, therefore, intra-ocular tumors. Melanotic tumors are only observed in such localities, where under normal physiological conditions, pigmented cells are found. It is probable that in this case the tumor took its origin from the pigmented cells of the sclera which are frequently found around the place of entrance of the posterior ciliary nerves.

TRAUMATIC HÆMOTHORAX. SIPHON DRAINAGE

Dr. JAMES H. KENYON presented a boy, ten years old, who was knocked down by a truck on May 23, 1913. On admission to the Fordham Hospital shortly after the injury, he was found to be suffering great dyspnoea, he was deeply cyanosed, with a drawn, anxious expression of the face. There was marked subcutaneous emphysema of chest, back, shoulders and neck. Eyelids were œdematous. The pulse was rapid and thready. There was a fracture of the right clavicle at the junction of the outer and middle thirds, also a fracture of second, third and fourth ribs. There was tympany over the right side of chest with diminished breath sounds.

Oxygen gave no relief, and all symptoms were rapidly becoming worse. With novocaine a small incision was made just below the right clavicle—just through the subcutaneous tissue, not into the chest cavity. This diminished the surrounding emphysema.

Another small incision was made in the fifth intercostal space in the mid-axillary line. This was followed by an outward rush of air, and a small amount of blood as the pleura was opened.

A rubber tube, one-quarter inch in diameter, was inserted to the depth of one and one-half inch. The tube made an air-tight fit in the opening and was long enough to terminate below the level of sterile water in a bottle by the side of the bed. This water trap permitted the escape of air and blood from the pleural cavity, thus restoring the

TRAUMATIC HÆMOTHORAX

normal pressure conditions. The condition immediately improved. Dyspnœa and cyanosis rapidly disappeared, and the emphysema became less.

The following day the patient was very comfortable, with no cyanosis, breath sounds normal, the air in the pleural cavity gone, and no longer any bubbling in the bottle. Emphysema decreased. The pulse was strong but the temperature 102° on that day. The temperature dropped to normal on the following day. On the third day the tube was removed and, as there was no discharge noted, the wound was strapped. The patient was allowed up on the fourteenth day and was discharged as cured on the sixteenth day after the injury.

DR. WILLY MEYER commented upon the method of siphonage used by Dr. Kenyon, saying that last winter at the Post-graduate Hospital he operated on a patient in whom he tried this drainage for the first time. It was one of those unfortunate cases in which the cancer was situated behind the aortic arch. After the tumor had been loosened and brought in front of the arch, it was seen that the tumor had broken through the œsophagus posteriorly, and had surrounded the vena azygos—which had to be ligated—a tremendous addition to the operation. But the patient pulled through the very extensive operation. We had made the incision through the seventh intracostal space, then cutting the ribs posteriorly. Back in the thorax in the ninth intercostal we inserted Dr. Kenyon's tube. We used a metal tube, which was compressed for a short distance, corresponding to the intercostal space, not round, but flattened; and outside it again continued in the regular round shape. We put a long cigarette drain into the bed of the œsophagus and passed it through and out of the tube at the end of which it was fixed with a thread passed through holes bored through so that we could unite the drainage with a bottle placed under the bed. In the number of hours the patient lived the apparatus worked very nicely; we saw that a good deal of sanguinolent fluid was discharged.

DR. W. S. SCHLEY said that he had published the results of his work on "aspiration drainage" in a series of cases in the *American Journal of the Medical Sciences* in 1908. He had tried it in a series of cases at the hospital in empyema, both in infants and in adults. The process of clearing the pleural cavity of pus and air was not only much accelerated and the recovery of the patient much hastened, but the after complications and the sequelæ, of persistent cavities, sinuses and possible infection of the rib, are diminished. Those cases did extremely well. He had not used it in an acute traumatic case with blood and air in the pleural cavity, and thought this to be very pretty application in thoracic surgery. But for the pus cases he had used it for many

years. He used the Politzer bag at the time of the report, to secure aspiratory action, and make it an ambulatory method. Perthes at an earlier date devised a system of aspiration by tubes led to the bedside from an air-pump. But the Politzer bag made the cases ambulatory just as soon as they were able to get out of bed. In three or four days, if they were able, they could get out of bed and walk around with a bag. Its manner of application is certainly simple, and the apparatus works extremely well. It is astonishing how quickly the lung fills out in the acute cases of empyema, often in four days. The chronic cases were slower, but much quicker than with simple drainage, and none left cavities or sinuses.

DR. A. S. TAYLOR described the method which was originated by Dr. Lund and which serves a very good purpose in empyema operations.

He resects one rib, making a skin incision down below, dissects up under the skin and goes through a rib higher up, and then puts in a rubber tube obliquely, underneath the skin, the skin flap acting as an automatic valve so that anything may come out of the chest through this tube but nothing may get in because the moment suction comes the skin flap falls over the end of the tube and produces automatic closure. That has the advantage of not requiring any foreign material except this short tube.

After reading of this method Dr. Taylor treated one or two empyemas in children with a short tube and found it exceedingly difficult to hold the tube in place, either the tube was found in the bed or it was found inside of the thorax—in neither place was it of any advantage. Therefore it appealed to him that a simple modification of this method, using only the tissues of the child, would work very advantageously. Therefore in a series of cases, now running up to twelve or fifteen, during a couple of years of service at Fordham, he has tried a method which works out very satisfactorily. The skin flap is made as already described. The pleura is first separated from the rib above, then divided and turned down over the rib below and fastened to the muscles with sutures. The pleura is used to prevent rapid healing of the under surface of the skin to the muscle lying over these ribs. Then this skin flap every second day is simply loosened by a pair of blunt scissors so that healing shall not take place too soon. He had found it necessary to make a large circle almost like an air-ring of gauze or cotton and fasten it with adhesive tape to the chest wall so that the hole through the rib and the hole in the skin are entirely protected from direct pressure, holding all the dressings away from the operative field. It has been his experience that where one has properly devised the skin incision in relation to the hole between the ribs, that in about four

TRAUMATIC EPILEPSY

days the lung comes down almost completely, breathing sounds are pretty nearly normal, and the discharge is free. In watching it on the operating table with every inspiration the skin is sucked tight up against the chest wall; with every expiration there is a spurt of pus, blood or air. There is rarely a persistent sinus where this method is used.

DR. ARTHUR L. FISK said that the principle of the method of drainage which had just been described by Dr. Taylor, and also that of Lund, was originated years ago by the late Dr. Arthur T. Cabot of Boston, who used a rubber shield with two rubber tubes fitting snugly into a hole in its centre; the inner ends of these tubes passing into the chest through the incision. The shield was fastened to the chest wall by adhesive plaster; about the external ends of the tubes was placed a doughnut of gauze; over this fluffy gauze was placed, and over that a square of thin rubber dam tissue which extended one inch beyond the edges of the fluffy gauze. Outside of all was a large dressing which was held in place by a chest binder. With expiration the contents of the chest were forced out, received into the dressings; on inspiration the thin rubber tissue sealed the tubes, so that air could not enter the chest. This dressing was found most satisfactory.

TRAUMATIC EPILEPSY

DR. JAMES H. KENYON presented a man, forty-eight years old, who in March, 1914, fell down a flight of stairs, striking the right side of his head.

He was unconscious for about two hours. There was a scalp wound two and a half inches long over the right frontal region, which was at once sutured. The patient was kept in bed for two weeks, chiefly because when he attempted to sit erect he was seized with severe headaches, and everything appeared black before him.

These symptoms continued for six weeks, diminishing in intensity, until he seemed quite well. Nine months after the injury, in December, 1914, he had an epileptiform convulsion, and two months later a second one.

These attacks were repeated at intervals, gradually increasing in frequency, until they occurred every two weeks. The attacks were preceded by a sense of gastric distress, then a fulness in the head and loss of consciousness lasting from one-half to three hours. They were accompanied by frothing at the mouth and by general clonic convulsions. At times, biting of the tongue. After each attack he became greatly prostrated. The family and past history were found to have no bearing on the case.

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Patient was admitted to the Neurological Institute on August 2, 1916. Examination showed a scar over the right forehead near the hair line. Otherwise the physical examination—urine, blood, spinal fluid, eye grounds, X-ray—was negative.

On August eighth he was operated upon and a large osteoplastic flap cut with the circular saw protected by washers, exposing the area from anterior to the scar to a point posterior to the motor area.

The bone was not depressed nor thickened. The dura was moderately tense, thick and white. Upon incising the dura considerable spinal fluid escaped and the cortex seemed slightly congested with a few grayish patches and signs of old exudate along the vessel walls. In the posterior frontal region several adhesions between the cortex and the dura were found. These were cut. A portion of the thickened dura, about one and one-half inches in diameter, including the area where the adhesions were found, was excised. The flap was replaced and the wound closed. The sutures were removed on the seventh day and the patient made an uneventful recovery. There was primary union and he left the hospital on the tenth day. Since the operation there have been no attacks nor headaches and the general condition of the patient has been excellent. The time which has elapsed since the operation is much too short to claim more than a temporary improvement. In this case, however, the pathological findings were so definite and the symptoms so marked and apparently lasting that an early exploration in these traumatic cases seems warranted.

DR. JOHN DOUGLAS said that about a year and a half ago he showed a patient before the Surgical Society on whom he had done an osteoplastic flap resection for traumatic epilepsy, in which he removed the thickened dura and replaced it with a flap made from the fascia lata and fat of the leg. At the time he showed this patient he had had no return of his epileptic convulsions. He saw him again within the last month; that was twenty months after his operation, the operation being done in December, 1914. During that time, although he had some twitching in his face, he had but one convulsion, which had occurred two weeks before he was last seen. He did a similar operation on another patient at Bellevue Hospital. This man left the hospital free of convulsions, but about two months after he left the hospital he had an attack of hemiplegia with paralysis of the side of the body on which he had previously had the convulsions. He returned to the Bellevue again last summer with a high temperature and a questionable diagnosis. He finally died, and at autopsy was found malignant endocarditis. At the autopsy they had the opportunity of opening his skull, and found that all of the fat which had been left on the flap

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with the idea of preventing adhesions to the cortex after the removal of the thickened dura had been entirely absorbed. The new flap which he had put in to replace the dura was densely adherent to the cortex as well as densely adherent to the bone of the osteoplastic flap.

DR. TAYLOR said that if a man has an injury to his head and then has epileptic convulsions, it is only fair to give him a small chance of permanent recovery which may result from cranial exploration. A case in point is that of a young man who was playing baseball, and while running to second base received the knee of the second baseman in the left squamous bone; and he maintained the imprint of that knee in his head over the succeeding year. He had been advised by his neurologist to have his head shaped out again to relieve the traumatism which had necessarily occurred to his brain, but they put it off for a year because he had had no discomforts and no symptoms. At the end of a year he began to have epileptic convulsions which came with rapidly increasing frequency. Finally at the end of about fourteen months from the time of his injury an osteoplastic was done on the left side of his head, which revealed that the whole squamous bone and a large part of the parietal bone had been jammed in so that they were nearly two inches below the proper level. Not only had the dura been rounded in in the same way, but a splinter of bone two inches long had penetrated the tip of the temporal lobe and had caused a good deal of induration in the brain tissue and a good deal of adhesion to the dura. The dura was loosened, the fragment bone was removed; nothing further was done. The bone fragments were replaced so that instead of giving the imprint of the knee inward the head shaped out again to its proper position. That man got a good primary union; his bone held in place so that his head was again symmetrical. And since that time, which is now two years, he has never had a convulsion; his mind, which at times was a little bit hazy, his vision, which at times was not quite satisfactory, have entirely cleared up so that he is back at business; he can now drive his automobile with safety and he is perfectly normal so far. Now that is over a period of two years, and it seems to him, therefore, that one should not be too pessimistic. If one out of twenty people can be saved from persistent epileptic attacks it is well worth exploring the whole twenty in order to get the one.

DR. WILLY MEYER said that in the early nineties he had such a case, where a man had been struck by a big piece of wood over the motor areas of one side. He had a typical Jacksonian epilepsy, and at that time they found by laying the parts open that there had been a communicative fracture and adhesions existed between dura, brain and bone. At that time we were not so far advanced in homoplastic surgery,

so we did heteroplasty with celluloid. He made a good recovery and was free for two years, when slight epileptic attacks returned, always in his right arm. A neurologist who saw him at that time advised the excision of the centre, which was done afterwards, and again a piece of celluloid implanted. For a number of years the man was perfectly free of trouble. But it didn't heal this time so nicely; we had to remove the celluloid. He is now down in Texas, and two months ago a letter was received stating that he had his old attacks again.

MIGRATION OF A SHELL FRAGMENT FROM THE RIGHT FEMORAL
VEIN TO THE RIGHT VENTRICLE OF THE HEART;
GENERALIZED GAS BACILLUS INFECTION

DR. H. H. M. LYLE presented a heart, a shell fragment and a vein with the following history:

The patient, Francis Alary, 8th Zouaves, was brought to the Ambulance June 16, at 3.30 A.M. Four hours previously he had received a perforating sheel wound of the left thigh 4 cm. above the knee, and a penetrating shell wound of the right thigh. A fluoroscopic examination of the thigh and abdomen failed to reveal any foreign body. The upper abdomen and thorax were not examined. The failure to find the shell fragment was puzzling, as the depth and direction of the wound seemed to preclude the possibility of the particle having fallen out.

The patient was in a condition of mild shock. Temperature 97.2° , pulse 126, respiration 28. Examination of the chest and abdomen were negative.

Operation.—The contused skin edges were cut away, the wound laid open, and the projectile tract lightly but methodically excised. No foreign bodies were discovered. At the bottom of the wound of the right thigh the femoral vessels were found embedded in a blood clot, the femoral vein was bruised but apparently intact. Four Carrel instillation tubes were inserted and 20 cc. of Dakin's solution were delivered to the wound every two hours.

The patient appeared drowsy and slept the major portion of the first two days. On the third day his abdomen became greatly distended and he complained of pain and tenderness over the spleen and right kidney. The distention was partially relieved by lavage and enemata. Jaundice appeared on the morning of the fourth day and was accompanied by pain and tenderness over the liver. The temperature rose to 102.2° , the pulse to 132 and the respiration to 32. Fine moist râles were heard at the left base. The area of cardiac dulness had increased, a distinct pericardial rub was heard, and the cardiac sound was indistinct. A provisional diagnosis of general gas bacillus infection with

CYST OF THE APPENDIX

pericarditis and pneumonia was made. In the afternoon there was a temporary improvement followed by sudden death at 5.30. Throughout the course the wound remained sterile.

Autopsy (Dr. Proctor).—Body of a man thirty-one years of age, moderate frame, fairly well nourished. Skin deeply jaundiced. No wounds of the abdomen or thorax. Wounds of the thigh clean. The wound of the right thigh is 10 cm. below and 5 cm. posterior to the anterior superior spine of the ilium. The tract leads forward, downward and inward to the femoral vein. In the external wall to the vein there is a small valve-like wound sealed by an organized clot. No local evidence of gas infection. Both lungs are œdematous, there is a fibro-purulent pericarditis with free gas in the pericardial cavity. The heart is enlarged and its external surface covered with a fibro-purulent exudate. The cut section of the heart gives a gaseous crepitation. There is a rough shell fragment free in the cavity of the right ventricle. The shell fragment measures 1.5 cm. in length, 0.9 cm. in width, and 0.5 cm. in thickness, and weighs 1.81 grammes. There are fibres of clothing adherent to the irregular surface of the shell. The liver, spleen and kidneys are enlarged. On cut section all give gaseous crepitation. There is no obstruction to the gall-bladder or gall-ducts.

Revised Diagnosis.—Perforating wound of the left thigh, penetrating wound of the right femoral vein, migration of the shell fragment to the right ventricle of the heart. General gas bacillus infection. No local infection of the wound.

Beside the extreme rarity of the case the following points are worthy of notice:

1. The carrying of a rough shell fragment by the blood stream from the right femoral vein to the right ventricle, the patient living four days and eighteen hours.
2. The sealing up of the wound in the vein.
3. The sterilization of the local wounds by the Carrel method, the generalized gas infection having undoubtedly arisen from the clothes on the shell fragment.
4. A fluoroscopic examination of the upper abdomen might have revealed the presence of the shell fragment. It then would have been a simple matter to have milked the fragment into an unimportant vein from where it could have been easily removed. This has already been done in the case of a shrapnel ball.

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DR. H. FISCHER presented the specimen which he had removed from a woman a few days ago. For some time this patient has suffered

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from indefinite abdominal pains in the lower abdomen. She has never been acutely ill. For several years she has had a small umbilical hernia that has given her some pain lately.

The patient is extremely stout and has a large pendulous abdomen. There is present a small umbilical hernia that contains some omentum which cannot be reduced. There is some pain on palpation. In the right lower abdomen there can be felt a tumor of about the size of an orange. This tumor is freely movable, a little painful on pressure, and is of cystic consistency. On bimanual palpation the uterus and left adnexa are found to be normal, on the right side the same tumor can be felt. The diagnosis was, therefore, cyst of the right ovary. On opening of the abdomen it was found that this cystic tumor was formed by the appendix. Its walls were extremely thin and its lumen distended by a thin fluid. The tumor, when delivered from the abdomen, was of the size of a large orange.

Some years ago I operated on a similar case. In this case the cystic appendix was of the size of the small intestine and had caused a colo-colic invagination into the transverse colon. It was filled with a thick mucus.

In both cases it must be assumed that the cyst formation was the end result of chronic inflammatory changes.

WARREN INCISION FOR THE EXTIRPATION OF BENIGN TUMORS OF THE BREAST

DR. A. V. MOSCHCOWITZ presented a woman from whom an adeno-fibroma the size of a pigeon's egg, located in the upper and outer quadrant of the breast, had been extirpated through a short-curved incision at the outer margin of the breast.

All incisions of this nature heal very kindly; the cosmetic result is excellent. Dr. Moschcowitz warmly recommends the incision for all operations of this nature.

STEWART INCISION FOR THE RADICAL AMPUTATION OF THE BREAST FOR CARCINOMA

DR. A. V. MOSCHCOWITZ presented two patients whose breasts had been amputated for a carcinoma by the incision and method described by Stewart, and published in the *Transactions of the American Surgical Association* for 1915. As the history and physical examination do not present anything out of the ordinary they were not given.

These two cases were presented principally in order to get an expression of opinion regarding the adequacy of the incision from those

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members of the Society who have used it. In Dr. Moschcowitz's opinion the final result as regards healing of the wound, cosmetic appearance of the cicatrix and function of the arm has been ideal in every respect. In fact the only drawback Dr. Moschcowitz found is that the operation is not as easily done as in the Halsted-Willy Meyer operation; and that in consequence there is at the termination of the operation a lack of that complete satisfaction of having really done a complete and thorough block dissection.

As a result of his all too limited experience Dr. Moschcowitz would say that it would be perhaps preferable to restrict the incision to very early cases, and to those in which the cosmetic result is of such importance as to overbalance other considerations.

CARCINOMA OF THE BREAST WITH VERY LATE METASTASIS IN THE OPPOSITE AXILLA

DR. A. V. MOSCHCOWITZ presented a woman, fifty-three years of age, who was referred to him June 6, 1916, when the following history was obtained:

Fourteen years ago amputation of the right breast for a carcinoma. Thereafter the patient was perfectly well up to a few months ago, when she began to complain of a drawing sensation, at first upon the right side of the neck, and then upon the left. These complaints were so trivial that she did not even consult her family physician up to a few days ago. When she did so, however, he discovered a tumefaction, the size of a fist, in the left axilla, whereupon he promptly referred her to Dr. Moschcowitz. By examination he found a perfectly smooth, pliable, non-adherent scar of an amputation of the right breast. The left breast was slightly pendulous, and upon repeated and very painful palpation, revealed absolutely nothing pathological. The left axilla was the seat of a tumor the size of a fist, composed of a number of apparently discrete glands, varying in size from those barely palpable to that of a plum. The skin was not adherent, nor was the mass adherent to the deep structures. It was neither painful nor tender. The rest of the physical examination was absolutely negative.

The history of the case, the length of time that had elapsed since the primary operation, and the absence of anything of a pathological nature in the left breast, as well as the physical nature of the tumor itself, led him into the error to exclude a diagnosis of a metastatic carcinoma. He was more inclined to the diagnosis of a primary lymphatic tumor, or of Hodgkin's disease. He advised an exploratory incision, with immediate examination of a frozen section.

Dr. Moschcowitz operated upon the patient on June 21, 1916, through an incision parallel with the outer edge of the pectoralis major, and extirpated a good-sized characteristic gland. Dr. F. S. Mandlebaum, Pathologist of Mount Sinai Hospital, reported that the specimen removed consisted of a large fused mass of lymph-nodes about the size of an orange, the individual nodes varying in size from a bean to a large plum. The freshly cut surface of the nodes is pinkish in color, rather firm in consistency, homogeneous in character, and presents the general appearance of a lymphosarcoma or some primary tumor of the lymph nodes.

In his opinion the diagnosis of metastatic carcinoma secondary to a primary mammary tumor arising in the ducts can be established in this specimen. In view of the fact that this patient had the breast of the opposite side removed many years ago, and inasmuch as there is no palpable tumor present in the remaining breast, he felt reasonably convinced that these nodes are secondary to the original tumor. Metastases in the axillary region of an opposite side are not the rule, but such conditions are not unknown. Although this form of carcinoma is somewhat uncommon, the records in the Pathological Laboratory of Mount Sinai Hospital show more than fifteen cases of carcinoma arising from the epithelium of the ducts. In some of these cases the axillary lymph nodes were involved, in others no metastases could be found. A patient recently operated upon by Dr. Moschcowitz in whom the axillary nodes were involved showed the same histological picture as that present in this case.

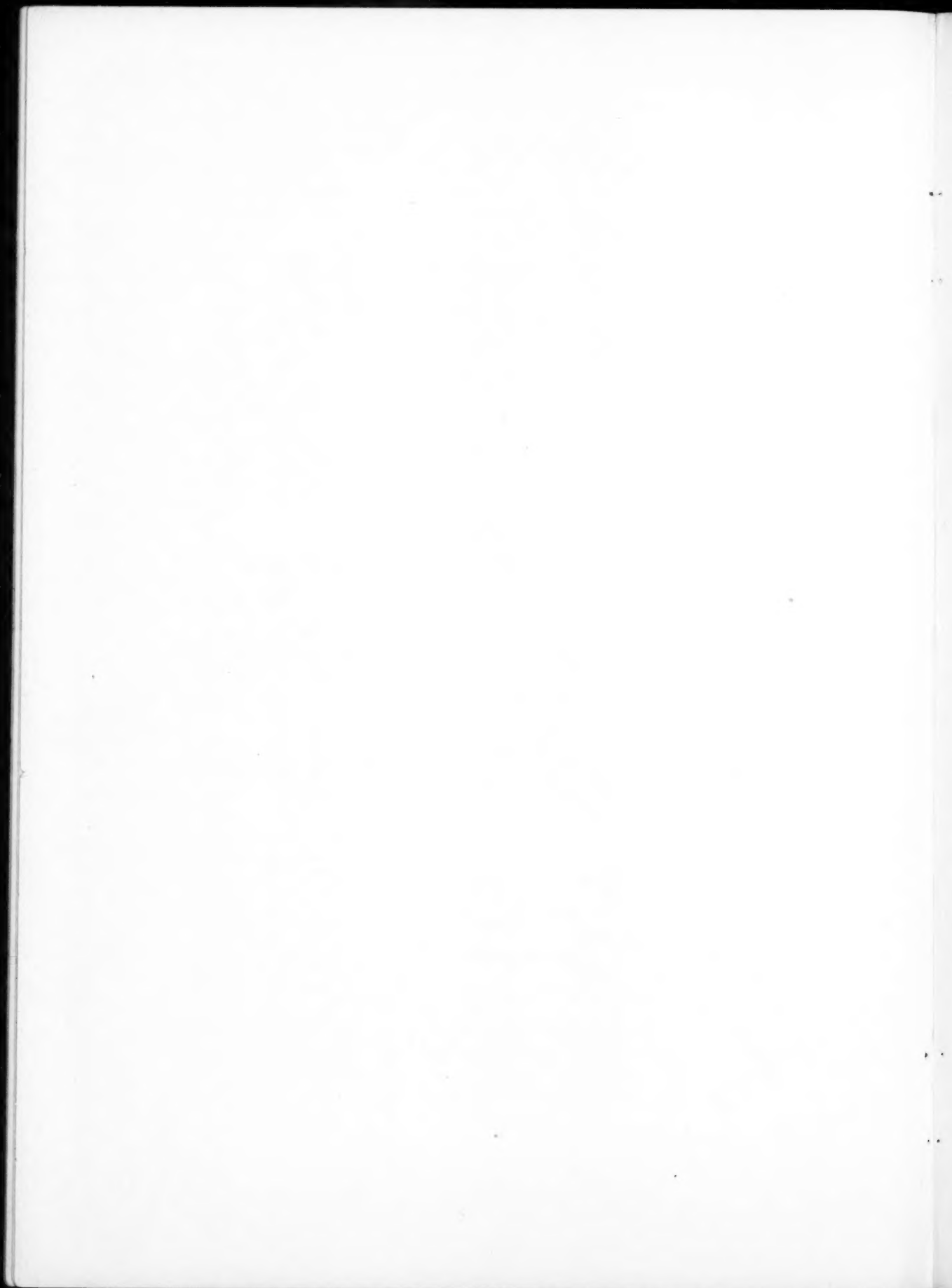
Dr. Moschcowitz himself stated that the freshly cut gland did not in the least resemble the usual picture of a carcinomatous gland. He, therefore, did not disturb the breast, but contented himself with the extirpation of the entire mass of glands from the axilla. He was more than chagrined, therefore, to learn a few days later from Dr. Mandlebaum the true nature of the glands.

A very minute examination of the thorax a few days later revealed to the right of the manubrium of the sternum an area of dulness about the size of a silver dollar. Dr. Jaches was good enough to X-ray the patient for him and they were able to obtain upon the X-ray plates the shadow of a tumor which shows up particularly well upon stereoscopic examination. A print of the X-ray plate (Fig. 1) and the report of Dr. Jaches are hereby appended:

"The Röntgen ray examination (fluoroscopic and radiographic) of the chest of Mrs. F. J. shows the following: In the upper portion of the right chest, corresponding in position to the second costal cartilage anteriorly, there is a circular shadow about one inch in diameter. On an



FIG. 1.—Anteroposterior view of thorax, showing metastatic tumor in posterior mediastinum.



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oblique examination this shadow is seen to be situated in the posterior mediastinum just behind the arch of the aorta. This shadow has the appearance of a large mass containing calcareous deposits, and is strongly suggestive of a new growth. Otherwise no abnormality is seen in the chest or in the bones of the thorax."

The case is presented on account of the following features:

1. The very late (after fourteen years) occurrence of metastases after an amputation of the breast for carcinoma, without any local recurrence.

2. The location of the metastasis in the opposite axilla.

3. The presence of a small but undoubted tumor in the posterior mediastinum, as seen in the X-ray, which may account for the contralateral axillary involvement.

4. The rarity of the pathological findings.

5. The difficulty of the pathological diagnosis in the fresh state, as well as in a frozen section.

It is furthermore of interest to state that thus far there is no local recurrence. The patient has, however, developed a slight cough, which may be accounted for by irritation of the trachea by pressure from the mediastinal growth.

In connection with this case Dr. Moschcowitz presented also two other cases of carcinoma of the breast.

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DR. PARKER SYMS read a paper with the above title for which see page 699.

DR. NATHANIEL GREEN said that in Dr. Syms's paper he has expressed himself as advocating a very radical removal of the breast with the muscles underlying it in these cases of chronic cystic mastitis. It seems that his position is the rational one in cases of thirty to forty years of age, but in the breasts of young women who are twenty or so it seems to me we can be more conservative. It was my privilege to visit the Mayo Clinic just a year ago and to see Dr. Judd operate upon one or two of these cases of chronic interstitial mastitis with cyst formation. The way I remember that he did it was to make an elliptical incision around the nipple and remove the whole gland down to the muscle; and he did not remove any more, neither the pectorals nor the axillary contents. I asked him if that were the thing he did generally in these cases. He said they had had about five hundred cases of this kind and they had followed that procedure with them. Sometimes they had been double, sometimes single. He said in the microscopical examination of these breasts a few of them had shown

changes indicating early carcinoma, but there had been no recurrence in this particular class of cases, and none had gone further to carcinomatous progress.

DR. JAMES M. HITZROT said that he thought that there were a large number of women, especially young and unmarried women, who have cystic mastitis who would refuse the radical operation. In a number of these cases he has used the Thomas incision and had extirpated the breast subcutaneously leaving the nipple. The space left by the removal of the breast can readily be filled in for cosmetic purposes by a flap of fat obtained from the neighborhood and this transplanted fat will, to a certain extent, restore the breast contour.

The radical operation should be necessary in only a very limited number of cases, and in these one would find at the clinical examination sufficient data to advise the more extensive operation. A careful examination of the gross specimen at the time of the removal should reveal the evidence of malignancy and would furnish sufficient check upon the operation.

The time limit is entirely too short in my experience to say much about recurrence in the case treated by the method given above, but so far there have been no cases of cancer or of recurrence in the cases thus treated. Some of the breasts removed have shown histological pictures which resembled closely the case shown in Dr. Syms's slides, *i.e.*, the case with the acini filled with cells exhibiting marked hyperchromatism.

DR. WM. B. COLEY said that his experience was entirely in accordance with Dr. Hitzrot's, and as a matter of record he would state that he did not recall a single instance in which he had removed one of these chronic mastitis tumors and primary tumors with recurrence. It would be extremely practical to remove the entire breast and pectoral muscle in young women, women under thirty, for this condition, because I don't think we have any facts or any evidence to warrant any other procedure.

DR. JOHN A. HARTWELL remarked that statistics from Boston, already quoted by Dr. Syms, show that four cases out of about eighty-eight who had had a partial operation for chronic cystic mastitis, later developed cancer. This is hardly a greater number than might be expected among eighty-eight women who had never had cystic mastitis. The cases above cited were operated upon by several surgeons. In some only a very local excision of the most diseased portion of the breast was done, while in others a complete mastectomy was restored to, but in no case was a radical operation as done for cancer performed. In his opinion, the radical operation, with removal of pectoral muscles

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and extensive axillary dissection, is not needed in the disease of chronic cystic mastitis. Even in those cases where hyperplasia is marked, and the lesion might be considered as showing some resemblance to beginning cancer, there is no indication for anything more than a complete mastectomy, because the disease, even when so advanced, is purely local, and has not yet developed a power of distant invasion.

Concerning Dr. Moschcowitz's case with the axillary lymph nodes, he hesitated to make a suggestion, but the X-ray plates suggested to him that the tumor in the mediastinum is a carcinoma of the thymus gland, the axillary involvement being metastasis from it. This suggestion was brought to his mind by recalling a case exhibited by Dr. Ewing last winter, and the microscopical sections exhibited by Dr. Moschcowitz are, as he says, rather unusual for breast carcinoma. (With Dr. Moschcowitz's permission the X-ray plates and sections were shown to Dr. Ewing and his opinion conformed to that given by Dr. Moschcowitz, namely, that it is a late metastasis of a duct cell carcinoma in the right breast. He says that the X-ray findings in the thymus tumors are much larger, much more pyramidal in shape, less nodular and extend higher in the neck.)

DR. W. S. SCHLEY referring to Dr. Moschcowitz's case of late recurrence after breast amputation said that the question of a time limit is, as is well known, out of date. He remembers a case of recurrence after thirteen years directly in the scar on the chest the size of a twenty-five cent piece. An excision of that was followed a year later by a second recurrence at the lower end of the scar; and a year after she died of metastasis in the spine, sixteen years after her original carcinoma of the breast. That was a long delayed recurrence, undoubtedly left-over cells. He believes in a number of our breast amputations that cancer cells are left even with wide skin excision, which should certainly be practised. In certain cases they remain probably walled in by scar tissue to develop later. He cannot but feel that the general condition of the patient plays a part, as in the above case where the carcinoma reappeared with the failing health of the patient due to curtailment of care and nourishment from altered circumstances. Its recurrence in the opposite axilla in the case presented has some unique features.

As regards all cases of cystic disease of the breast, the process is essentially benign in character. Does carcinoma occur in these cases any more frequently than it occurs in the breast that is not the seat of cystic disease? A certain number of them, a very few of them, will show early carcinomatous changes, but we see infinitely more cases

of carcinoma of the breast where the carcinoma is the whole thing and apparently the rest of the breast is not involved in any benign process. The process varies from individual simple cysts through multiple cysts up to the complex derangements with tumor formation. Where to draw the line in our surgical work is often difficult. Surgeons are frequently justified in conservative operations. A single or even multiple cyst formation does not necessarily call for complete extirpation. In a cystic degeneration, so called, of the breast with innumerable multiple cysts, multiplication of the cellular element and the intra-cellular substance, extirpation is certainly indicated, partial or complete. A partial or complete resection of the breast is the proper procedure for all benign tumors of the breast, except the simple thin-walled cyst; not so much for fear of cancer degeneration as that we have a progressive process. There are a number of these simple cysts that occur as an involution process, and one is justified by clinical experience in a conservative treatment of them. Associated discharge from the nipple always calls for more radical measures. Shepherd, of Montreal, is a strong advocate of conservatism in the case of simple cysts. He speaks from forty years' experience with many hundreds of cases treated by nothing more than aspiration. He has carefully followed these and says that not only they do not develop carcinoma but that the majority do not even require a subsequent tapping. It is, however, certainly a justifiable procedure to extirpate, and should always be done if any sense of thickening remains after aspiration, or if there should be coincident nipple discharge. In cystic disease, especially with thickening and evidence of a diffuse condition, partial or complete extirpation is certainly called for. The great majority of these benign breasts do not develop carcinoma, and it is questionable whether cases of cystic disease of the breast develop carcinoma any more frequently than breasts where no such condition exists. He did not advocate conservatism in all these various breast conditions, as nearly all call for operative interference, but thought we should have a proper appreciation of the pathology as well as of the possibilities.

DR. WM. COLEY stated that he had had one case of local recurrence of carcinoma in the breast seventeen years after the primary removal, and metastasis into the other breast, a case of about fourteen years.

DR. WILLY MEYER remarked, concerning Dr. Moschcowitz's rare case of recurrence, that he had often seen late recurrences, one for instance, eight years after a radical operation. He had seen three cases of cancer up near the axilla which proved to be affections of supernumerary mammary glands. With regard to the cases discussed by Dr. Syms, these cases certainly are precancerous in some instances.

CYSTIC MASTITIS

He recalled one lady in the early forties who had such a tumor. A radical operation was refused and a simple removal of the tumor was done. She was well for ten years and then presented herself with a far advanced cancer of the breast. In one instance he had a patient similar to one that Dr. Syms mentioned where there was a local tumor, a fibro-adenoma, usually combined with cysts. Frozen sections were made; the report came, "benign." After further search, however, the report came in, "in the centre cancer." A radical operation was done, and the patient is to-day perfectly well. In another case where there was a large cystic tumor, but the patient was descending from a cancerous family—four, five or six members having had carcinoma—there was not the slightest sign of disease in the axillary gland. He urgently advised radical operation; it was done to satisfy the patient and keep her from worrying. The report came, after a most careful analysis, "perfectly benign."

Now, that gives us reason to think, particularly in the face of those positive statements Dr. Abbe has made again before the American Surgical Association last year, and lately D. Shepherd, of Montreal. With the simple operation done, sometimes the patients remain well. But in his own work if he had to deal with a patient in the real cancer age, say above thirty-five, never would he lend his hand to a simple surgical procedure as tapping. He would insist upon radical operation. If it is not accepted—that is for the patient to decide.

DR. H. B. DELATOUR thought surgeons should be guided by the history and condition of the patient. He had followed cases for fifteen years, both single and multiple cysts, and had yet to see a recurrence or development of carcinoma following in any.

The Stewart operation he had performed several times, and while it gives you a much better access to the axilla than one would naturally expect, one feels hampered, does not feel as if access to the axilla were as perfect as with the other operations.

DR. JOHN F. ERDMAN said that if the question of cystic fibrosis or cysto-adenoma, etc., is taken up, especially where there is a discharge from the nipple from the thin straw-colored to the bloody or very dark fluid, one cannot eradicate from the mind the idea that in some one or other of those cysts there is present a papillomatous outgrowth; and over forty per cent. of these papillomatous outgrowths, according to the reports from Massachusetts General and Johns Hopkins Hospitals, are reported as being malignant, primarily. Bearing that in mind, in all of these growths, it is his invariable rule to do a complete amputation of the breast without removal of the pectorals but dissecting off the fascia. In former years he was dissecting the breast out subcu-

taneously, retaining the nipple. The breast would fill up to a considerable degree. The patients who retained the nipple did not feel that they had sustained the mutilation that other women had. At the present time he does not save the nipple at all.

In regard to the Stewart incision, during the close of last winter's sessions in this Society, he reported twenty-three or twenty-seven, I have forgotten which, cases in which operations were made by means of the Stewart incision. Since that time he had done quite a number more. He finds no difficulties in exposing the contents of the axilla at all in the Stewart incision, but we are not able to take off the same amount of skin that we are in the ordinary Meyer operation. That is, if the growth extends up far you must make the Meyer operation type of incision rather than the Stewart. And Stewart also claimed that it was not used for all types of breast removal—that is, in the malignancies. But what he had found in this series of cases is that over seventy-five per cent. of them suffer a great deal of axillary pain. Nevertheless it is true that they suffer more pain immediately after and subsequent to the operation—that is, some months after—than in the ordinary incision. In abduction, with extension of the arm, there is a drawing on the flap which is adherent to the chest wall, and this they complain of.

DR. MOSCHCOWITZ said that when Stewart reported his operation he mentioned that during the last five years he has operated forty cases by this method; in the discussion which followed, Gibbon reported forty-seven similar operations, and apparently with the greatest satisfaction. The radicality of the cure in Dr. Moschcowitz's case is not now under discussion; the elapsed time is far too short for that, and for that matter he is willing to concede, or at least hope, that the cases are cured. His main reason for presenting these cases was to get an expression of opinion regarding the exposure obtained during the operation. The method has undoubtedly a great many advantages, so that in spite of his present dissatisfaction, he will continue to use it; he is in hopes that the fault is his, and that with increasing experience he will overcome his present dissatisfaction.

As regards the case of recurrence of the breast carcinoma, he really did not present it so much as a case of late recurrence, but as a case of late recurrence in the axilla opposite to the involved breast. The histopathology of this case is so involved, that he refers the reader to the report of the pathologist. In reply to Dr. Hartwell, Dr. Moschcowitz merely wishes to add, that if Case I is a metastatic carcinoma in a gland—and of that there is not the slightest doubt—then the case under discussion being entirely similar to that, must also be a glandular carcinoma.

CYSTIC MASTITIS

Finally, as regards the paper of Dr. Syms, Dr. Moschcowitz wishes to say that in all cases of carcinoma of the breast, his views are very radical, both as to the indications and as to the operation. But until a particular case is proven to be a carcinoma beyond any doubt he would be inclined to be somewhat more conservative than Dr. Syms. It also appears to Dr. Moschcowitz that Dr. Syms was somewhat hypercritical regarding the value of frozen sections. It is true that in a majority of the cases even a gross examination of the cut tumor will very quickly decide between the benign and the malignant tumors, but it is in the exceptional case in which the pathologist's opinion becomes valuable. Cases like the one presented by Dr. Moschcowitz to-night have been so rare in his experience as to be practically unique.

Dr. SYMS, closing the discussion, remarked he tried to use judgment in each individual case as to whether there is indication for operation or not and, if an operation is decided upon, whether or not the operation should be a radical or a local one. He had not performed the radical operation in many of these cases.

But an academic consideration of this question is quite another thing. As one studies this remarkable disease one is impressed with its complex nature and with its progressive character. If the various processes represent progressive stages—inflammation, hyperplasia, tumor formation, cancer—then we must concede that it is only a question as to how far a given case progresses whether or not cancer will develop.

If that is so there will be made mistakes in trying to differentiate, for there are no symptoms that indicate a transition into cancer.

The statistics from the Mayo Clinic, as reported by Dr. Greene, are interesting, but they are not convincing. Keen observers have reported a varying percentage of cancer among their cases of chronic cystic mastitis. If their observations are true, it would mean that there must have been a number of cancer cases in the Mayo Clinic's list. If that is so, they have been employing an inadequate operation in the treatment of cancer of the breast. It cannot be claimed that simple amputation of the breast is the proper procedure in cases of carcinoma.

In considering this topic one must carefully distinguish between chronic cystic mastitis and true fibro-adenomata. The tumor-like masses found in chronic cystic mastitis are not true tumors; they are tumor-like masses; they are not encapsulated, isolated tumors; they cannot be enucleated; they are part of a complex process.

In case it is determined that the breast should be removed, simple amputation should be seldom employed. The radical ablation is no more disfiguring, no more disabling, and, in his experience, no more dangerous than the lesser operation.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held October 2, 1916.

The President, DR. CHARLES H. FRAZIER, in the Chair.

FRACTURE OF SKULL, DECOMPRESSION AND DRAINAGE

DR. NATHANIEL GINSBURG presented a youth, aged fifteen years, who was admitted to the Jewish Hospital, September 4, 1916, on account of a cranial injury sustained a half-hour previously. He was in partial stupor, with a rapid pulse which quickly slowed down to sixty beats to the minute while the examination was taking place. There was a large hæmatoma of the scalp to the right of the external occipital protuberance, with a rupture of the soft parts about two centimeters in extent, extending down to the bone. The pupils upon admission were equal, but within a short time, the right pupil became widely dilated, and the inequality remained marked. The skin was cold, and perspiration profuse. Vomiting at first of normal gastric fluid was quickly followed by fluid containing fresh blood, and was projectile in type. The oropharynx showed free bleeding from above. There was ecchymosis of the left upper eyelid, and a small hæmatoma was present over the left frontal region. The left ear was almost totally avulsed from its attachment. The patient had had one convulsive seizure.

He was immediately taken to the operating room, and lumbar puncture revealed intracranial hemorrhage, the fluid being deeply colored by blood. Under ether anæsthesia, the scalp was incised down to the bone, employing a vertical incision over the right occipital area, the incision extending equally above and below the line of the lateral sinus. A fissure fracture of the occipital bone was revealed with free bleeding externally. The skull was quickly opened by drill and rongeur forceps, the gutter in the bone extending to the superior limit of the break. The inferior extent of the fracture apparently passed into the foramen magnum and it was not deemed advisable to remove all the bone down to this point. Free bleeding from the diploic vessels was easily controlled by Horsley's bone wax. The extradural clots were wiped away and the dura was incised above and below the ten-

FEMORAL ARTERIOVENOUS ANEURISM

torium, avoiding the lateral sinus and exposing the cerebral and cerebellar cortices. Blood-tinged cerebrospinal fluid under much pressure escaped, and the dural incisions about two centimeters each in length were not sutured. A small piece of rubber tissue was introduced down to the dura in the lower angle of the wound and the scalp sutured by interrupted iodized catgut and silkworm gut sutures. The drain was removed twenty-four hours later. The wound was dressed with gauze moistened with solution (1-4000) bichloride.

The nasal and oral cavities were sprayed hourly with an antiseptic solution, no packing of the nares being employed.

Except for free vomiting and extreme restlessness and headache during the first twenty-four hours, convalescence was uninterrupted, and the boy left the hospital well on September 17, thirteen days after the injury.

The important features of this case are prompt operation with drainage above and below the tentorium cerebelli, by dural incisions, frequent washing of the pharynx, and final recovery.

Dr. Ginsburg said that he resorted to immediate decompression with drainage above and below the tentorium cerebelli in this case, because he regarded the presence of free blood in the cerebrospinal fluid as evidence of intradural hemorrhage. The symptoms of cerebral compression were indisputable, and prompt relief of intracranial pressure would give the best chance of recovery.

Although he could not say that this patient would not have recovered without the prompt occipital decompression and the drainage which was thereby established, it was true that at the operation, the bloody cerebrospinal fluid, which escaped when the dura was incised over the cerebral and cerebellar cortices, was under great pressure, and rapid recovery ensued following decompression.

FEMORAL ARTERIOVENOUS ANEURISM

DR. EDWARD B. HODGE presented a man, twenty-three years of age, who was admitted to the Presbyterian Hospital, April 3, 1916, with an egg-sized pulsating swelling in the right thigh, with a history that three months before admission, in a machinery accident, a piece of steel about an inch in length, had been driven into the inner anterior surface of his right thigh. Two days later, he noticed a non-painful swelling, egg size, near the site of injury. This had varied in size, but was now larger than at first. In the last three weeks, there had been a peculiar sore feeling on the inner part of the lower leg. The general examination was negative. About seven inches below Poupart's liga-

ment and in line with the femoral vessels, was an egg-sized pulsating swelling. A plain thrill was felt here and also over the femoral vessels as high as Poupart's ligament and for three inches below the tumor. There was a loud continuous bruit heard over the mass accentuated with the beat of the artery. This was also heard from Poupart's ligament as far down as the popliteal space. There was no tenderness nor pain nor was there tenderness over the "sore" area in the lower leg. Proximal pressure obliterated the thrill, while distal pressure had no effect. There was a good pulsation in both tibials.

Operation (April 7).—Under gas-ether. Tourniquet applied high upon thigh. On incising the soft parts, there was found much inflammatory reaction, matting the tissues together over and about the sac. The latter was located at the beginning of Hunter's canal. After considerable difficulty from the infiltration of the muscles and from oozing, the mass was cleared into healthy tissue above and below. Temporary tape ligatures were placed on both sides of the sac. The vessels were found tightly adherent for about two inches. The foreign body was felt posterior to them and was removed. It was found impossible to close the communication between vein and artery without opening the sac, as had been done in a previous case. The sac was incised and the vein found lying in front and to the inner side of the artery with a communication between the two about three-quarters of an inch long. There was considerable bleeding which could be checked by the provisional tape ligatures. An attempt was made to suture the communication from within the sac, but the tissues were so friable that the suture would not hold. After many attempts, this plan was abandoned and quadruple ligation with excision of the involved vessels was done. Hæmostasis was completed after the removal of the tourniquet and wound closed in layer suture. The operation was long, taking over two hours, due to the oozing and the many attempts to suture the opening. Patient had a rapid pulse at its conclusion, but soon reacted and had a normal convalescence, with a temperature of 100.2° for its highest. Two days after operation, the right leg was one and three-quarter inches larger than the left just above the knee. The elevated foot remained warm and of good color at all times, and on the eighth day, pulsation in the tibials was felt. He was discharged cured on the 17th day. The foreign body proved to be a piece of steel, shaped like an arrow head, about one-third of an inch long.

DR. JOHN H. GIBBON said that the application of a temporary ligature in the case of traumatic aneurism is feasible, but when dealing with an aneurism, the result of a diseased blood-vessel, the employ-

FRACTURE-DISLOCATION OF HUMERUS

ment of such a ligature is dangerous. The failures and fatalities which have followed the performance of the Matas operation have been largely due to the injury produced at the site of the application of the temporary ligature. The most carefully applied temporary ligature may result in secondary aneurism or rupture of the vessel. He had operated upon a good many cases of aneurism of the popliteal and femoral arteries and in all he had used digital compression with the most satisfactory control of circulation. In one case of iliac aneurism, he first opened the abdomen and had an assistant control the circulation by digital compression. This is a safer and more intelligent method of control than either that obtained by ligature or tourniquet, as no damage can be done to the vessel. In cases such as Dr. Hodge reports, of course, the temporary ligature is less likely to do harm.

DR. J. STEWART RODMAN recalled a case in which he had the privilege of assisting Dr. Horsley, of Richmond, Virginia, operating at the Medico-Chirurgical Hospital.

This case was one of arteriovenous aneurism of the femoral vessels, in which Dr. Horsley, after much difficulty in freeing the vessels from surrounding tissue, performed a similar operation of separating artery and vein and restoring their calibre as reported in a previous case of Dr. Sweet and Dr. Hodge (*ANNALS OF SURGERY*, 1915, lxi, 367).

The operation lasted for three hours, was very tedious and as the vessels were friable there was considerable bleeding. Temporary ligatures were placed above and below the suture points in both vessels in case secondary hemorrhage should make it necessary to ligate these vessels. The patient had several small secondary hemorrhages which were controlled by packing.

On about the tenth day following the operation a furious secondary hemorrhage occurred making it necessary to ligate both vessels. A few days following the ligation, although the limb seemed warm and the collateral circulation fairly well established, the patient collapsed and died apparently from sudden failure of the circulation. Death probably resulted from embolism.

FRACTURE-DISLOCATION OF HUMERUS; RUPTURE OF AXILLARY ARTERY; GAS BACILLUS INFECTION

DR. JOHN SPEESE reported the following case: Mrs. M. K., aged fifty-six, was admitted to the Polyclinic Hospital, July 12, 1915, suffering from shock and injuries following a fall from a trolley car. On examination, numerous superficial abrasions were found, an extensive swelling over the left shoulder-joint was present, the patient was

unable to move the left arm or hand and absence of the radial pulse on this side was noted. Under nitrous oxide anæsthesia crepitus was elicited, but a dislocation of the humeral head could not be definitely determined because of the extensive swelling. An X-ray taken immediately afterward, showed fracture of the surgical neck and marked displacement of the head of the humerus.

On the following day as there was slight swelling and cyanosis of the hand, and no return of the radial pulse, operative interference was necessary as the axillary artery seemed to be either injured or pressed upon by the dislocated head of the humerus. An incision made in the line of the artery released a large amount of clotted blood, the almost completely detached head of the humerus was excised, and the irregular and jagged projections from the shaft of the humerus were removed. On sponging out some of the clotted blood in the region of the axillary artery, a completely detached portion of the vessel, three centimeters in length was found. The torn vessel contained a thrombus in both ends, from which there was no bleeding. End-to-end suture of the artery was impossible because of the amount of tissue lost and because of the torn and ragged condition of the vessel. The circumflex artery was noted immediately above the proximal end of the torn axillary artery, the thrombus apparently not interfering with its lumen for the vessel was pulsating vigorously and seemed already to have undergone some degree of compensatory dilatation.

On the following day the patient's arm was warm, did not exhibit any evidence of gangrene, although several blebs, in the region of the abrasions sustained at the time of the accident, were present and gave the crackling sensation characteristic of gas bacillus infection. Cultures and smears from the blebs were reported to contain the *bacillus aërogenes capsulatus*. Further attempt to save the patient's arm had to be abandoned on account of this complication, and a high amputation of the shoulder performed twelve hours after the blebs appeared. The flaps were not sutured, the wound was flushed thoroughly with peroxide of hydrogen and gauze soaked in this solution was packed loosely in the wound. The patient exhibited no other symptoms of infection due to the gas-forming bacillus, and the wound healed slowly by granulation.

DR. A. P. C. ASHHURST said that during the past summer he had had a similar case of gas bacillus infection under his care at the Episcopal Hospital. When he came on duty in the wards the patient had been in the hospital for a couple of days with a compound fracture in the upper part of the humerus (railroad crush). Two days later amputation was done for gangrene. In cutting through the deltoid, gas escaped. He put aside the knife he was using and completed

ENDARTERITIS OBLITERANS

the operation with a second knife. Emphysematous gangrene spread up to the shoulder and partly along the chest; it then stopped and the patient got well. Cultures showed the presence of the *B. aërogenes capsulatus*.

ATLO-AXOID DISEASE

DR. J. T. RUGH read a paper, with the above title, illustrating it with lantern demonstrations.

ENDARTERITIS OBLITERANS

DR. D. L. DESPARD read a paper with the above title.

DR. EDWARD B. HODGE said that he had a patient during the summer who suffered the most distressing pain and was absolutely unrelieved by morphia. The great toe only was affected and the pain was of the spasmodic variety. The Ringer's solution was tried and after the fifth or sixth injection there was improvement, but afterward the condition relapsed and was worse than before. From sixteen to eighteen injections were given, and there was no improvement; neither was there relief from morphia, of which he could take any amount. The man was finally relieved by amputation of the toe.

DR. E. G. ALEXANDER said that it might be of interest to report that one of the cases upon which Dr. Müller did an arteriovenous anastomosis, and which he mentioned among his failures, came later to Dr. Deaver's service at the Episcopal Hospital with a beginning gangrene of the toes of his other foot. He refused to have anything done surgically. He was put to bed with the limb elevated and given potassium iodide internally. He made a good recovery. He stated that this foot had felt exactly as the other prior to his operation at the University Hospital, as his toes were cold and numb.

DR. P. G. SKILLERN, JR., said, with reference to the practice of Dr. Stewart, who had stretched the sciatic nerve in cases of endarteritis obliterans, after the method of Chipault, to be effective the stretching must reach the nerve-trunk in whose trophic area the diseased vessel is situated. It seemed to him that a more intensive reaction in these nerves may be obtained by Réclus's operation of "neurotripsis," or dissociation of the nerve-fibres by a metallic instrument. Comparing the effects of nerve-stretching with those of nerve-laceration (neurotripsis) Smits, who made use of these procedures in the treatment of *maux perforants*, varicose veins and varicose leg ulcers, says that without any doubt nerve-laceration is more efficacious than stretching operations at ordinary distances, since lacerating the sciatic nerve is sufficiently radical to be followed by an action on its most distant

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branches, while simple nerve-stretching has by no manner of means such an effect. Not only has neurotripsis an indirect influence upon the sympathetic system, thus increasing the trophic energy of the tissues, but it also frees the axis cylinders from the effects of pressure, which may be due to involvement of the nerve by extension of the cicatricial process from the blood-vessel (popliteal space; leg; varicose veins and cutaneous nerves), or else to disease of the vessels of the nerve itself (*arteria comes nervi ischiadici*; varicosities of veins within sciatic nerve), thus often accomplishing a double purpose, and often relieving nerve-pain at its *fons et origo*. What segment of the sciatic (or anterior crural) nerve is to be subjected to neurotripsis must vary with the individual case.

DR. N. GINSBURG remarked that there is nothing specific in the treatment of endarteritis obliterans of the type termed Buerger's disease. These cases are usually seen when the process is terminal, and all surgical measures are purely palliative in nature. Conservatism, when possible, should be employed in dealing with the devitalized extremities. However, if impending gangrene is present, early amputation will spare the patient much suffering and the danger of mixed infection. He had performed ligation of the femoral vein on five occasions, one of the patients being an old diabetic in coma, and in whom the operation had no value. The other four cases were typical cases of Buerger's disease. In one patient marked relief has occurred, following the loss of the big toe and the adjacent metatarsal bone, the foot has been spared. He was not prepared to state that the progress of the disease in this case was inhibited by the performance of the operation. The other three cases were failures, and one patient died with every evidence pointing to an ascending thrombus, occluding the vena cava and the renal veins. This case was a poor operative risk, and died of suppression of urine.

With regard to intravenous injections of sodium citrate solution, experience is too limited to definitely state what value can be placed upon this form of treatment.

DR. DESPARD, in closing, remarked regarding the salt solution, he did not use it in the cases reported. He had used the method in only one case and that was unsuitable for a fair test, for which reason he did not report it.

In reference to the neuritis, he thought that it is an ascending one. Whether all the pain and distress these patients suffer and the symptoms referable to the nerve are of secondary or primary origin he did not know. We have no evidence at this time from which to draw definite conclusions. There is something more than simply a clot in the vessels.

RECONSTRUCTION OF THE BILE-DUCT

AUTOGENOUS FASCIAL RECONSTRUCTION OF THE BILE-DUCT

DRS. NATHANIEL GINSBURG and JOHN SPEESE read a paper with the above title.

DR. JOHN H. JOPSON spoke of the first method of anastomosis, the direct suture of the divided ends of the common bile duct, in which there is no loss of substance, in order to place on record a case in which he did this operation with success. The patient was referred by Dr. John H. Musser, Jr., for operation for carcinoma of the pylorus. He had had an old ulcer and the carcinoma was thoroughly engrafted upon it. The gastro-hepatic omentum was extensively infiltrated, there was strong adhesion to the pancreas, and in resecting the stomach he got beyond the line of safety and cut completely across the common bile duct. He immediately clamped it off, completed the partial gastrectomy and did an end-to-end anastomosis of the bile duct with chromic catgut, suturing the union with a mattress stitch of linen anteriorly. The region was drained. There was profuse leakage of bile on the second and third days, which then stopped suddenly, and the man made a good recovery. He was in excellent health thirteen months later.

DR. P. G. SKILLERN, JR., called in question the permanency of the patency of the lumen of the bile duct, for the fundamental reason that the operators failed to provide an epithelial lining to their exotic duct. It is a law in surgical pathology that when the epithelial lining of a soft-tissue tube is destroyed or absent, and does not regenerate, the tube becomes involved in stricture-formation at the site of the missing epithelium. This law applies to the Eustachian tube, the œsophagus, the stomach (hour-glass stomach), the intestines (especially the rectum), the bile duct, the ducts of salivary glands (including the pancreas), the Fallopian tube, the ureter, and urethra. Taking the urethra, for example, the first stage of stricture-formation is destruction with permanent loss of epithelium followed by the formation of a granular patch and ultimately the inevitable cicatricial constriction; and no plastic operation for the permanent restoration of a patent lumen succeeds unless the exotic tissue transplant bears with it an epithelial lining. Another illustration is afforded by the behavior of intestinal fistulæ. Nothing closes so surely and rapidly as the large intestine fistula (cæcum) when not lined by epithelium; nothing is so sure to persist forever as a similar fistula when lined by epithelium from bowel to skin. Witness the persistency of branchiogenic fistulæ! Commenting upon Sullivan's method of reconstruction of the bile-ducts by

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union by rubber tube of common or hepatic duct to duodenum, W. J. Mayo says, "This is by all means the simplest method of restoring the bile-channel, but unfortunately the newly-formed channel is not mucosa-lined, and we must expect that eventually contraction will take place" This is one reason why Walton's method of reconstruction, which was referred to by the essayists, appealed to him, for restoration is made by a pedicled duodenal flap. The second reason why he preferred Walton's method is based upon what seems to him to be irrefutable logic, namely, the pedicled duodenal flap is lined by mother epithelium from which the anlage of the hepatic bud is derived, so that by this method the place of the missing common duct is taken by homologous tissue lined by homologous epithelium, and provided epithelial edge of the graft has been accurately contacted with epithelial edge of duct-stump, with this proviso the chance of stricture-formation should be practically nil. Whether or not, in the plastic of the essayists, epithelial regeneration will spread from the duct-stump along the exotic fascia duct to the duodenum is problematic; if so, the situation would be saved; if not, the inevitable constriction which forms the basis of Mayo's argument against Sullivan's method will occur. In any event the interesting problem offers first-class opportunities for experimental investigation.

DR. GINSBURG replied, with reference to Dr. Skillern's contention that fascial reconstruction of the bile duct might be followed by subsequent stenosis, owing to the fact that the newly-established biliary tract is not lined by epithelium, that it must be borne in mind that the fistulous tracts most difficult to close are those which do not have an epithelial surface. We all know that perineal fistula, abdominal fecal fistula, and fistulous tracts about joints will persist indefinitely as long as there is the pressure of fluid for drainage. What they aimed to create, by the use of an autogenous fascial transplant, is a closed biliary fistula bridging over the gap in the bile duct as the result of injury or disease.

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All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS OF SURGERY

227-231 S. 6th Street
Philadelphia, Penna.

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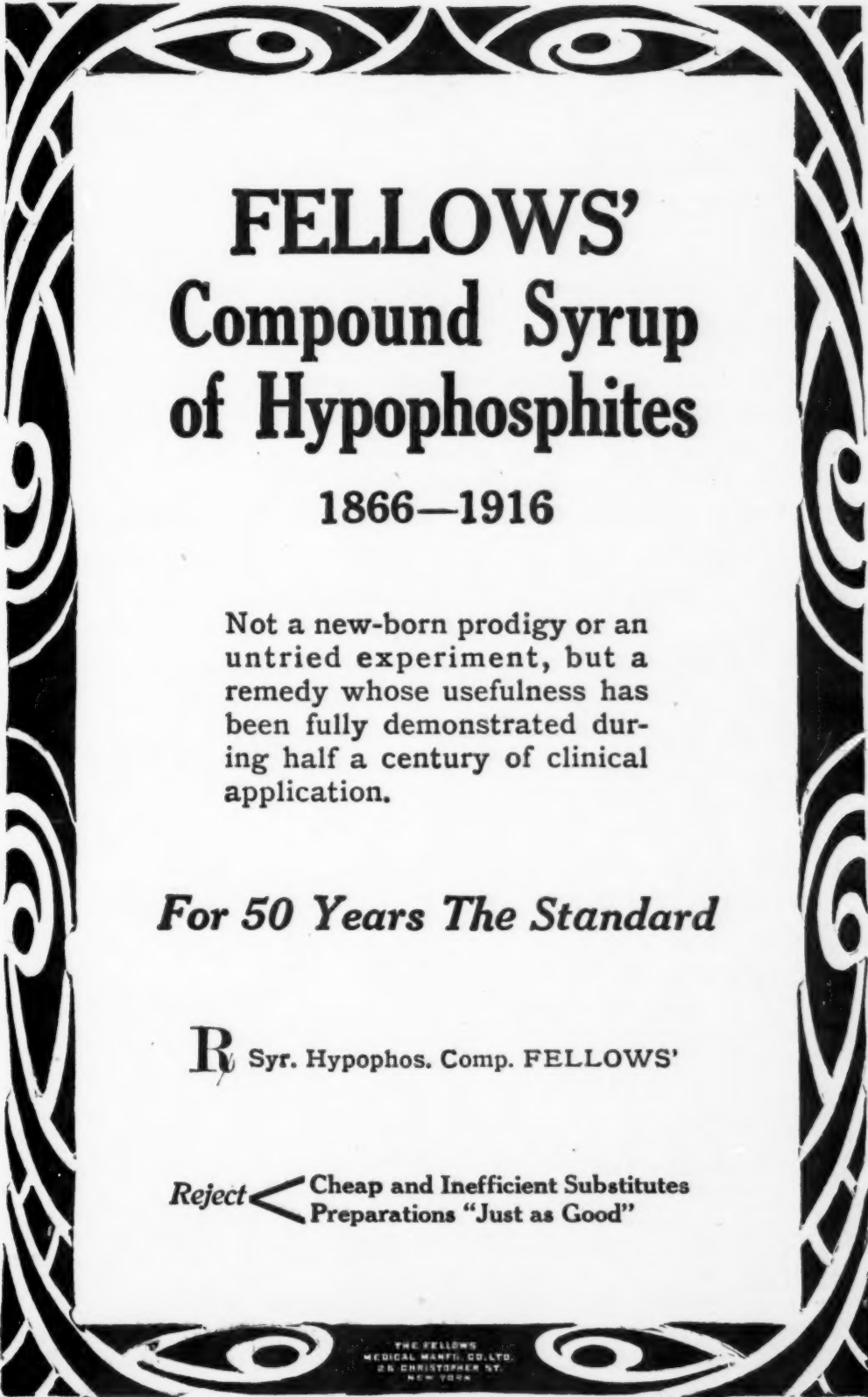
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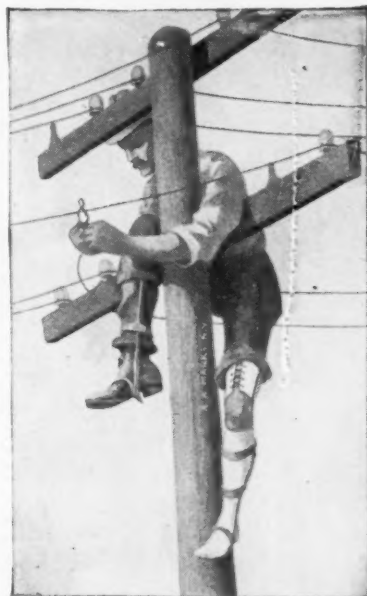
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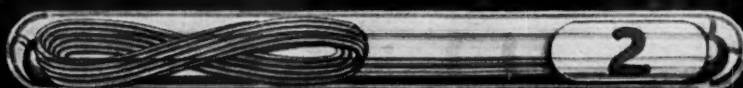
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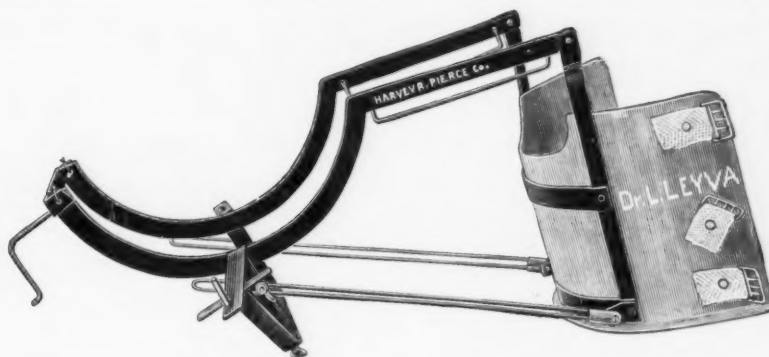
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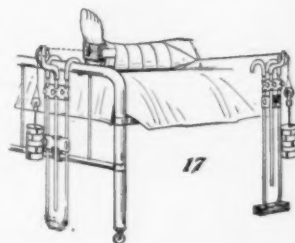
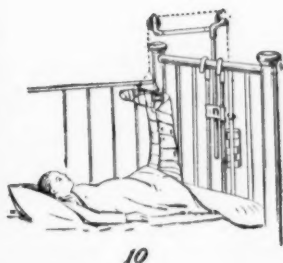
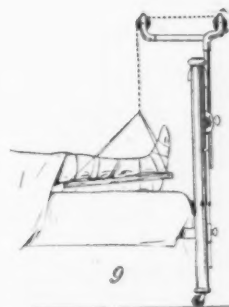
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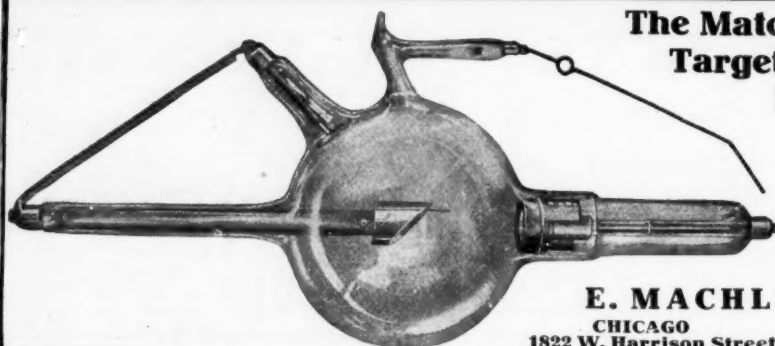
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